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THESIS

ALTERNATIVES IN AUTOMATING SMALL PROCUREMENT FIELD ACTIVITIES; A COST-BENEFIT ANALYSIS

by

Christopher Barstow Drake

and

Steven Grady Carver

June 1986

Co-Advisor: Raymond W. Smith
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This thesis examines the costs and benefits associated with automating the procurement function at the small activities of the Navy Field Contracting System (NFCS). Large activities are currently scheduled to receive the Automation of Procurement and Accounting Data Entry (APADE) system. This research evaluates the appropriateness of utilizing APADE in the small NFCS activity as opposed to an alternate existing system that can satisfy the automation needs of the small NFCS activity.

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Alternatives in Automating Small Procurement Field Activities; a Cost-Benefit Analysis

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Submitted in partial fulfillment of the
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MASTER OF SCIENCE IN MANAGEMENT

from the

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June 1986

ABSTRACT

This thesis examines the costs and benefits associated with automating the procurement function at the small activities of the Navy Field Contracting System (NFCS). Large activities are currently scheduled to receive the Automation of Procurement and Accounting Data Entry (APADE) system. This research evaluates the appropriateness of utilizing APADE in the small NFCS activity as opposed to an alternate existing system that can satisfy the automation needs of the small NFCS activity.

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I. INTRODUCTION

A. BACKGROUND

The renewed emphasis on weapon systems modernization and expansion that accompanied the strong defense policies of the administration of President Ronald Reagan, has created an ever increasing volume of procurement actions to be performed by various Department of Defense contracting activities. With this impetus, the Deputy Secretary of Defense set forth the thirty-two Carlucci Initiatives designed to enhance the procurement procedures within his expansive department. One such initiative called for the acquisition of computer systems that would help improve the efficiency of the procurement process by providing automated tools to field purchasing personnel. [Ref. 1; p. 11]

The United States Navy fully embraced these initiatives and began to reinforce its efforts to automate the process of procurement to the maximum extent feasible. These efforts resulted in numerous different automated systems being implemented at distinct procurement locations with no integration capability. In an effort to coordinate automation efforts and resources, the commander of the Naval Supply Systems Command (NAVSUP) appointed the Procurement Automation Task Force in October of 1984 to review the requirements of the Navy Field Contracting System (NFCS) and to evaluate the efforts in procurement automation.

> The objective of the PATF was to: 1) review the current DOD and NAVSUP NFCS procurement automation initiatives, particularly APADE Redesign, 2) report on APADE Redesign project management, project scope, resourcing, and 3) to revise the requirements statement and functional description. [Ref. 2]

The Automation of Procurement and Accounting Data Entry (APADE) system that was the PATF's primary focus had its start in 1974 as one of the first formal initiatives by NAVSUP to automate procurement procedures within the NFCS. APADE I began as a research and development project to determine the feasibility of converting the all manual procurement documentation preparation process to an automated system using minicomputer applications. "The test (APADE I) met with limited success but the potential for greater improvement in this area as well as other labor intensive procurement functions was recognized." [Ref. 3, p. 1]

Drawing from these results, Naval Supply Systems Command Deputy Commander for Contract Management (NAVSUP 02) initiated APADE II, a modular based minicomputer system. This system was to provide a standard set of hardware and software that could be configured in response to the performance characteristics required by each of the eleven unique receiving sites. The primary features of the improved APADE II system included:

1. Requisition tracking and document control.
2. Automated document generation.
3. Source data automation
4. Management information reporting.
5. Interface with existing databases.
6. Real time, interactive processing. [Ref. 3, p. 2]

Although APADE II was an improvement in procurement automation, its scope was limited to small purchase. In 1980, recognizing this limitation, NAVSUP 02 directed a redesign of the APADE II system to provide a broader base of applications. The first attempt at redesign was contracted to Booz-Allen and Hamilton (BA&H) to develop system level and functional documentation. During the period of this contract, 1980 through 1983, several major problems appeared in development:

> The software development did not satisfy the objectives and performance requirements specified by the Functional Manager; nor did the modular approach used in the design prove workable in the system's development process. The capability of the computer hardware was, at best, marginally adequate to handle the work. [Ref. 4, p. 39]

As a result, NAVSUP 02 commenced renegotiations with BA&H in an attempt to alleviate these significant obstacles. NAVSUP decided, in October of 1983, that the APADE II redesign should be based on Tandem TXP hardware so as to be capable of full integration with the ongoing Stock Point Logistics Integrated Communications Environment (SPLICE) project. Negotiations for development within the Tandem environment failed to achieve an acceptable price, so in June of 1984, responsibility for the design, development and implementation of APADE II was passed to the Fleet Material Support Office (FMSO). This current design effort was the central focus of the Procurement Automation Task Force in late 1984.

The critical need for an effective automated procurement system throughout the NFCS was well documented by the PATF's finding that:

> The Navy Field Contracting System (NFCS) consists of 831 activities (ICPs, NSCs, NRCCs, etc.). When compared to other DOD branches, the NFCS has a lower percent of resources dedicated to the purchase application than other DOD branches. Given the volume of annual procurement actions and dollar obligations, it is apparent that the NFCS requires significant automation to successfully and efficiently accomplish its mission. [Ref. 2]

Under the current redesign initiative, APADE will provide increased productivity through automation for the NFCS at the major activity level. These major activities represent only thirty-five of the new 905 activities within the NFCS. These thirty-five sites, when combined with the two Inventory Control Points (ICPs) resystemization, routinely account for 50% of the total number of purchase actions and 90% of the total dollar value of all Navy purchase actions.

There remain, however, an extremely large number of purchase actions performed by smaller NFCS activities encumbered by the inefficiencies, backlogs, and costly operation associated with manual processing systems.

Given the need to improve productivity through automation at these smaller NFCS activities, NAVSUP is concerned with identifying a cost effective means to provide such automation while maintaining continuity throughout the Navy Field Contracting System. There are two primary alternatives in automating the acquisition process at the small activity level. The first is by linking all NFCS activities to the APADE system, while the second involves adapting an existing automated system (other than APADE) to a local level while providing selective interaction with the APADE system. Each of these alternatives is possible, but each will yield different associated costs and benefits.

B. OBJECTIVES

The objective of this thesis is to identify and compare the cost-benefits associated with linking the small NFCS activities into the APADE system versus those associated with adapting an existing automated procurement system (other than APADE) for small activity use.

This thesis will first review the scope and responsibilities of both the large and small NFCS activities, discuss the current status of the APADE system, and identify the most comprehensive existing automated procurement system alternatives for the small NFCS activity. This will be followed by a cost-benefit analysis comparing the two alternatives for small activity automation.

C. RESEARCH QUESTIONS

To achieve the objective of the research, the following question was posed: Given the existing requirements for automation, should small contracting activities link to the existing APADE system or develop their own local automated contracting system?

To answer the basic research question, the following subsidiary questions were asked:

1. What is the impetus behind current automation requirements?
2. What are the automation needs of the small contracting facility?
3. Can APADE efficiently fulfill the needs of the small contracting office?
4. Are existing locally developed systems, when implemented, fulfilling the automation needs of the small contracting field activity?
5. Could an existing local system be efficiently linked to APADE to provide common database information for continuity within the procurement system?
6. What are the associated cost-benefits of linking to APADE and those of implementing a local system?
7. Given the above cost-benefits of the alternatives, which alternative provides the best support for the small contracting facility within the present environment of budget austerity?

D. SCOPE, LIMITATIONS, AND ASSUMPTIONS

This research will concentrate on the use of existing technology to automate the small NFCS activity in a cost effective manner. The existing technology will consist of locally developed systems currently in use at various field contracting activities as well as the APADE system. While the development of a new and unique automated system to satisfy the automation needs of the small activity is certainly possible, such development is beyond the scope of this thesis and the expertise of its authors. Further, the development of a new system would require an exorbitant amount of

R&D funding, time, and diversion of resources that adaptation of an existing system could forego.

Due to the limitation of time, personal resources, and available data, rather than providing comparative cost-benefit analyses of all available systems, this thesis will compare the appropriateness of linking the small NFCS activity to APADE versus the adaptation of the one existing locally developed system that in the authors' evaluation, best satisfies the automation needs of the small procurement office.

Throughout this thesis, it is assumed that the reader is familiar with the Federal Acquisition Regulations (FAR), understands the Navy's procurement process, has a general understanding of management information systems (MIS), and is knowledgeable with respect to the financial orientation of cost-benefit analysis. Particular assumptions associated with the cost-benefit analyses conducted as part of this research will be identified in the presentation of those analyses.

E. LITERATURE REVIEW AND METHODOLOGY

An intensive review of available material concerning Navy automated procurement systems was made during the preliminary stages of this research effort to determine the extent of research already conducted in support of NFCS automation.

The research data base for this thesis was formulated through the use of the Defense Logistics Studies Information Exchange (DLSIE), the Defense Technical Information Center (DTIC), the Naval Postgraduate School library, and reports published by the Department of Defense. Additionally, a large portion of the data base was generated by interviews conducted with various personnel associated with the Naval Supply Systems Command, Naval Sea Systems Command, Fleet Material Support Office, Naval Data Automation Command, Naval Supply Centers, Naval Regional Contract Centers, Naval Aviation Systems Command, the Integrated Technologies Group of the Federal Computer Corporation, Tandem Corporation, and various activities within the Navy Field Contracting System. Those individuals providing significant contribution to this research effort are recognized in Appendix A.

F. DEFINITIONS AND ABBREVIATIONS

A comprehensive glossary of abbreviations and acronyms used within this thesis is presented as Appendix B. Working definitions of terms and concepts used in this thesis will be provided within the text of the thesis as deemed necessary.

G. SUMMARY OF FINDINGS

This research effort determined that the automation of the Navy Field Contracting System (NFCS) beyond the current scope of the APADE project is both feasible and cost-effective when utilizing APADE technology. The expansion of the APADE system to encompass the 291 NFCS activities with purchase authority in excess of $1,000, not originally included in the APADE project, proved to be the most advantageous alternative. The Automated Procurement Tracking System/Automated Procurement Production and Management System (APTS/APPMS) was found to be the next best alternative to APADE for automating the small NFCS activities. However, this alternative proved to be less comprehensive than APADE and not cost-effective in its implementation.

H. ORGANIZATION OF STUDY

This thesis is organized to provide the reader with an overview of the need for automation throughout the NFCS, the role of both the large and small procurement activities, a review and status update of the APADE project, identification of alternative automation systems, and the costs and benefits associated with automating the small NFCS activity with APADE and with an alternative system. It will be segregated into the following chapters.

Chapter I provides an introduction to the Navy Field Contracting System automation requirement and the initiatives taken to fulfill that requirement.

Chapter II defines the major contracting facility, its scope and responsibility, as well as providing an overview and current status of the Automation of Procurement and Accounting Data Entry (APADE) system.

Chapter III identifies the scope and responsibility of the small NFCS activity, their requirements for automation, and possible automated system alternatives.

Chapter IV provides the cost-benefit analysis of linking the small procurement activity to the APADE system.

Chapter V provides the cost-benefit analysis of implementing an existing local automated system at the small procurement activity level.

Chapter VI presents the researchers' summary and conclusions.

II. THE LARGE CONTRACTING FACILITY AND THE AUTOMATION OF PROCUREMENT AND ACCOUNTING DATA ENTRY (APADE) SYSTEM

A. DEFINITION OF THE LARGE CONTRACTING FACILITY

Large procurement facilities within the NFCS will be defined, for the purposes of this research report, as those activities designated to receive APADE implementation within the currently defined scope of the APADE project. These thirty-five procurement activities each account for at least 0.1% of total Navy procurement actions or 0.1% of total Navy procurement dollar value, or both, which was the cutoff recommended to NAVSUP by the PATF [Ref. 5]. These activities cover a range of claimancies and are identified in Table I by activity type along with their respective forecasted APADE implementation dates.

For fiscal year 1984, the 831 NFCS activities made purchases in excess of ten billion dollars for goods and services. The thirty-five large contracting facilities accounted for 4.8 billion of these dollars. [Ref. 6, p. A-9] This share of procurement volume is expected to increase. A graphical presentation of the actual shares of total procurement action for FY 1985, for both number of actions and total dollar volume, is presented in Figure 2.1. The large contracting activities of the NFCS continue to provide more than 40% of all purchase actions and account for more than 50% of the total dollar value.

TABLE I

LARGE CONTRACTING FACILITIES

NAVAL SUPPLY CENTERS	
NSC Norfolk, VA	JAN 86
NSC Puget Sound, WA	JUN 86
NSC Jacksonville, FL	AUG 86
NSC Pearl Harbor, HI	MAR 87
NSC Oakland, CA	MAY 87
NSC Charleston, SC	JUL 87
NSC San Diego, CA	FEB 88
NSC Pensacola, FL	MAR 88

NAVY REGIONAL CONTRACT CENTERS	
NRCC Philadelphia, PA	SEP 86
NRCC Philadelphia - Newport, RI Det.	SEP 86
NRCC Long Beach, CA	OCT 86
NRCC Washington, DC	JAN 87

NAVAL SUPPLY DEPOTS	
NSD Yokosuka, Japan	JUL 88
NSD Subic Bay, PI	AUG 88
NSD Guam	OCT 88

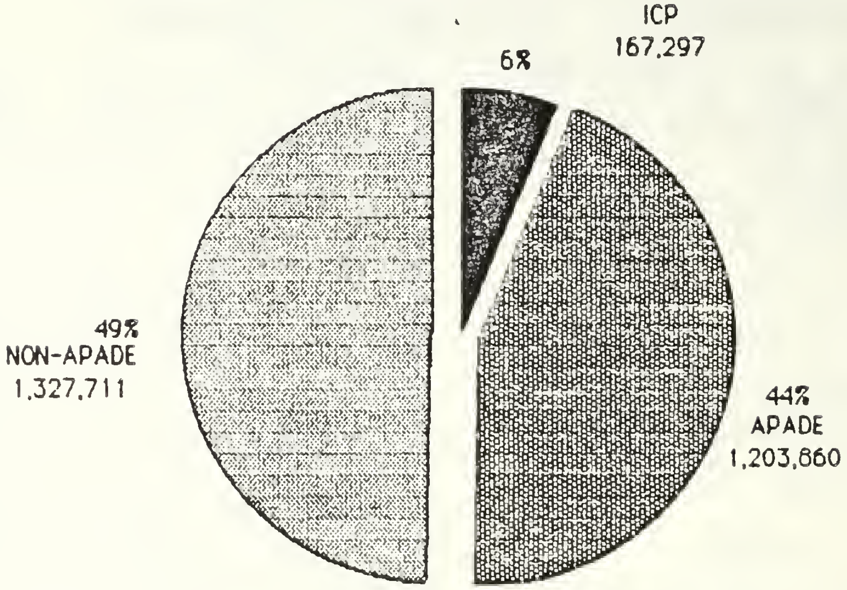
NAVAL LABORATORIES	
DTNSRDC Bethesda, MD	APR 88
NWC China Lake, CA	NOV 88
NSWC White Oak, MD	JAN 89
NCSC Panama City, FL	JUN 89
NADC Warminster, PA	JUL 89

MISCELLANEOUS	
NOS Indian Head, MD	MAY 88
NAS Point Magu, CA	JUN 88
NAS Pax River, MD	SEP 88
NOSC San Diego, CA	FEB 89
NUSC Newport, RI	MAR 89
NSY Norfolk, VA	APR 89
NSY Portsmouth, NH	MAY 89
NAVRESSO Staten Island, NY	AUG 89
NAC Indianapolis, IN	SEP 89
NOS Louisville, KY	SEP 89
MCAS Cherry Point, NC	OCT 88
NWCS Crane, IN	NOV 89
NSY Mare Island, NY	NOV 89
NTSC Orlando, FL	DEC 89
NAETC Lakehurst, NJ	JAN 90

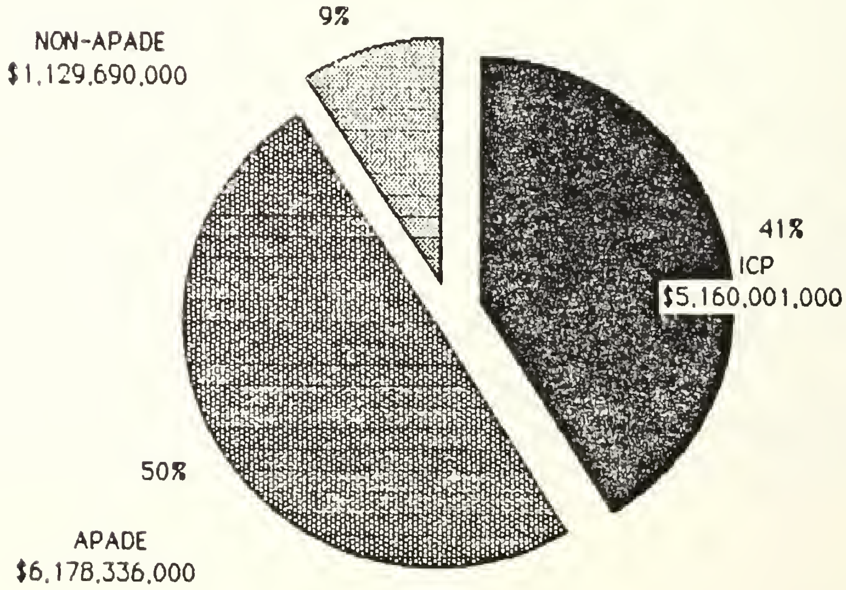
Source: [Ref. 6, p. A-3]

B. SCOPE AND RESPONSIBILITY

As members of the Navy Field Contracting System, these activities are established to contract for materials and services under the delegated authority of the Naval Supply Systems Command. These activities, in fact, make up a large subset of what NAVSUP designates as major field contracting activities. Major contracting activities are granted their purchase authority, ranging from $10,000 to unlimited, directly by NAVSUP.



DISTRIBUTION OF PURCHASE VOLUME, * TRANSACTIONS, FY 85



DISTRIBUTION OF PROCUREMENT VOLUME, DOLLAR VALUE, FY 85

Figure 2.1 Distribution of Procurement Volume FY 85

Specific activity responsibilities vary slightly depending upon its claimancy, mission support definition, and commodity purchase tendencies. A general overview of these responsibilities would include the following:

1. Buy items in support of claimancy needs.
2. Make purchases which are in excess of the purchase authority of those smaller NFCS activities designated in a regional support network.
3. Provide contract management advice to those activities within a designated area.
4. Centralized commodity buying.
5. Grant purchase authority to naval shore activities within their support region, in writing, as necessary to maximize purchasing efficiency and control. [Ref. 7, p. 1-5]

Additionally, all purchasing activities of the NFCS are responsible for conducting their operations with strict adherence to Federal Acquisition Regulations (FAR), the Navy Acquisition Regulation Supplement (NARSUP), DOD Supplement to Federal Acquisition Regulations (DFAR), NAVSUP Publication 467, and other relevant instructions and directives.

As mentioned earlier, the scope of activity of these thirty-five large contracting facilities is enormous. Table II provides an insightful display of just how large the contribution of these activities is in relation to total Navy procurement activity. During the next twelve years, volume is expected to increase at an average annual rate of 9% for these facilities [Ref. 6: p. A-14]. It can be readily summized from this level of activity, that attention to individual procurement actions will suffer as the burden of increasing volume is felt across the population of NFCS buyers. Without significant help to deal with procurement volume levels and the increasing complexity of the Navy's

TABLE II

NFCS PURCHASE ACTION VOLUME FY 1985

ACTIVITY	# TRANSACTIONS	% TOTAL	$ VOLUME (000s)	% TOTAL
Navy Regional Contract Centers				
Philadelphia & Newport Det.	32,250	1.19	859,655	6.89
Long Beach	20,019	0.74	320,632	2.57
Washington, DC	3,511	0.13	322,372	2.59
Naval Supply Centers				
Norfolk	71,912	2.66	192,005	1.54
Puget Sound	52,941	1.96	148,010	1.19
Jacksonville	23,975	0.89	44,804	0.36
Pearl Harbor	35,396	1.31	46,522	0.37
Oakland	53,447	1.98	164,123	1.32
Charleston	68,406	2.53	187,654	1.51
San Diego	42,375	1.57	132,055	1.06
Pensacola	16,690	0.62	35,438	0.28
Naval Supply Depots				
Yokosuka	29,152	1.08	45,551	0.37
Guam	11,466	0.42	18,696	0.15
Subic Bay	15,093	0.56	30,065	0.24
Naval Laboratories				
Bethesda	21,780	0.81	101,823	0.82
China Lake	38,423	1.42	253,508	2.03
White Oak	45,636	1.69	333,935	2.68
Panama City	9,157	0.34	36,389	0.29
Warminster	12,906	0.48	231,092	1.85
Miscellaneous Activities				
NOS Indian Head	6,204	0.23	37,225	0.30
NAS Point Mugu	19,599	0.73	69,097	0.55
NAS Pax River	24,990	0.93	205,069	1.64
NOSC San Diego	27,817	1.03	214,961	1.72
NUSC Newport	22,395	0.83	233,886	1.88
NSY Norfolk	29,786	1.10	70,160	0.56
NSY Portsmouth, NH	17,367	0.64	85,657	0.69
NAVRESSO Staten Island	318,468	11.80	450,168	3.61
NAC Indianapolis	29,110	1.08	330,490	2.65
NOS Louisville	12,480	0.46	52,509	0.42
MCAS Cherry Point	23,339	0.86	26,090	0.21
NWCS Crane	24,037	0.90	70,297	0.56
NSY Mare Island	26,691	0.99	40,001	0.32
NTEC Orlando	4,542	0.17	743,915	5.97
NAETC Lakehurst	12,500	0.46	44,482	0.36
TOTAL LARGE ACTIVITIES	1,203,860	44.61	6,178,336	49.55
TOTAL ICPs	167,297	6.20	5,160,001	41.39
Other NFCS Activities	1,327,711	49.19	1,129,690	9.06
TOTAL NFCS	2,698,868	100.00	12,468,027	100.00

NOTE: Columns do not add precisely due to rounding of percentages.

Source: [Ref. 8: p. 3-7]

procurement system, NFCS activities would find it increasingly more difficult to meet their stated responsibilities to the procurement system and the American taxpayer, and would continue to suffer public ridicule from publicized unfortunate procurement oversights such as overpriced socket wrenches and ash trays. [Ref. 9]

C. REVIEW OF THE PROCUREMENT PROCESS

1. BACKGROUND

At the end of World War II, the United States Government realized that the rules for federal procurement had to be improved. In 1947, the Armed Services Procurement Act was passed. The Armed Services Procurement Act accomplished two significant objectives. First, it created procurement policy for periods of national emergencies, and secondly, it recognized negotiated procurement as a required acceptable method of procurement. In 1972, to further improve the federal procurement process, Congress established a Commission on Government Procurement. The primary purpose of this commission was to review all facets of government procurement and report their findings to Congress. Based on the findings of the Commission on Government Procurement, Congress in 1974 created, under Public Law 93-400, the Office of Federal Procurement Policy (OFPP). [Ref. 10: p. 646]

The main focus of the OFPP was to develop a simplified and uniform procurement system for the federal government which would take into consideration the differing procurement processes and program objectives of various executive agencies. In response to that requirement, the Office of Federal Parocuarement Policy created the Federal Acquisition Regulation (FAR) in 1978. The primary purpose of the FAR system was to reduce redundancy and regulatory proliferation in government procurement. The FAR maintains that an agency in the federal government implementing procurement regulations must not conflict with, restate, or paraphrase the FAR, must conform to its numbering system, and must also be published in Title 48 of the Code of Federal Regulations. The FAR's ultimate goal was the consolidation of Government-wide procurement regulations into a single, simplified and understandable regulation, reduce the proliferation of regulations among and within agencies, and to make it easier to do business with the Government, particularly for small, minority and women-owned firms. The Federal Acquisition Regulation became effective on April 1, 1984. [Ref. 11: p. 14]

In July of 1984, as a result of the Congress' concern over the lack of competition in government procurement, the Competition in Contracting Act (CICA), PL 98-369, was enacted. The primary purpose of CICA was to increase competition in the award of federal contracts. This was accomplished by revising existing legislation which had called for the Defense Department and other federal agencies to purchase goods and services using the formally advertised method of procurement, unless it met one of seventeen established exceptions. If the acquisition qualified under any of these exceptions, only then could it be negotiated. With the passage of CICA, Congress recognized negotiations as a preferable competitive method of procurement. The Act, for the first time, clearly established a legislative requirement to compete regardless of the procurement method utilized. [Ref. 12: p. 6]

2. PRINCIPAL PROCUREMENT METHODS

There are two principal methods of government procurement; Formal Advertising (Sealed Bids) and Negotiation. Up until recently, approximatly 8 to 10 percent of federal procurement was accomplished by Formal Advertising while 90 to 92 percent was done through negotiation. Advertised bidding is accomplished through a five step process. First, the Invitation For Bids (IFB) must be prepared. An IFB is a complete procurement package including specifications, contractual requirements, and terms/conditions of the contract. Second, the IFB is distributed to a wide variety of possible bidders or contractors. Third, a public opening, reading, and recording of the bids is conducted at the time and location described in the IFB. Fourth, each individual bid is evaluated. Any bids not conforming exactly with the terms and conditions of the IFB are eliminated. A contractor or bidder cannot change, withdraw, or replace their bid once they have been opened. Fifth, the contract is awarded to the responsible and responsive bidder with the lowest price, as long as it is deemed in the government's best interest. With the inactment of the Competition and Contracting Act of 1984, Formal Advertising became the Sealed Bid process, and the Negotiated method of procurement became the accepted method unless all of the following conditions were met:

1. Two or more suppliers must be capable of supplying the wanted item and be interested in doing so.
2. There is adequate time for solicitation, submission, and evaluation of sealed bids.
3. The award is made on the basis of price and other price-related factors.
4. Definitive specifications for the items purchased are complete, and accurately describe the item so that all bidders understand precisely what the government's requirements are. [Ref. 10: p. 647]

If one or more of the aforementioned conditions for sealed bidding is not satisfied, the competitive negotiated method of procurement must be used unless it meets one of the seven exceptions for "Other Than Competitive Negotiation" [Ref. 12: p. 9]. These seven exceptions are:

1. Property or services are available from only one source and no other type of property or services will satisfy the needs of the agency. This includes follow-ons and unsolicited research proposals.
2. The agency's need is of such unusual and compelling urgency that the United States would be seriously injured unless the agency is permitted to limit the number of sources (must still obtain maximum competition practicable).
3. It is necessary to award to a particular source or soures in order to maintain a facility in case of national emergency, to achieve industrial mobilization, or to establish or maintain an essential engineering research or development capability provided by an educational or other nonprofit institution or a federally funded research and development center.
4. It is required by the terms of an international agreement treaty, or by written direction of a foreign government who is reimbursing the agency for the cost of the procurement.
5. The statute expressly authorizes or requires procurement through another agency, from a specified source, or the agency's need is for a brand name commercial item for authorized resale.
6. Disclosure of the agency's needs would compromise national security unless the number of sources is limited (must still obtain maximum practicable competition).
7. The head of an agency determines that it is necessary and in the public interest, and gives Congress thirty days written notice before the award (nondelegable). [Ref. 12: p. 8]

The Competitive Negotiation method of procurement allows the contracting officer more flexibility. A Request for Proposal is used in lieu of an IFB, and the contracting officer is free to hold meaningful discussions with, and award the contract to the most responsive and responsible contractor. Therefore, he can award the most advantageous contract to the government.

3. PROCUREMENT PROCESS

The procurement process starts with the receipt of the requisition document by the Technical Division of the Customer Services Department. Once the requisition is received by the purchasing department, it is verified and assigned a purchase requisition number for further processing and tracking. The verifing process includes a check for completeness of the requisition, corresponding national stock number (NSN), quantity, and approximate price of the item. At this point in the process, the requisitions are passed to the individual buyers or to the purchasing supervisor for distribution. Requisitions are classified according to an estimated price level. There are three price levels or classifications, large purchase (greater than $25,000), small purchase synopsis ($10,000 to $25,000), and small purchase (less than $10,000).

a. LARGE PURCHASE

In a requisition classified as a large purchase, the purchasing supervisor or director distributes each requisition, first, to the Small And Disabled Business Utilization Specialist (SADBU) for review. This review is a check to evaluate it's potential for small business award or possible 8A set-aside. Once the small business review is completed, the requisition is passed to the contract specialist. The contract specialist then developes the acquisition plan that includes, all of the requirements for the acquisition specifications, source selection criteria, competition requirements, reporting requirements, and the establishment of the source selection team. It is at this point that the contract specialist selects the solicitation document. If the purchase request meets all of the criteria for a sealed bid, an IFB is established and the procedures outlined in paragraph C.2 on page 24 apply. If it does not, then a RFP is utilized. At this point, the contract specialist synopsizes the proposal in the Commerce Business Daily (CBD) to notify prospective suppliers of the anticipated contract. After fifteen days, the RFP is sent to all respondents to the CBD synopsis and to other suppliers contained on the contract specialist's Bidders Mailing List.

For a minimum of thirty days, proposals are received from the various suppliers. Based upon the source selection criteria, the contract specialist checks each individual proposal for the responsibility and responsiveness of the bidder. It is at this point that the competitive range is established. The contract specialist will now hold meaningful discussions/negotiations with bidders within the competitive range. Upon completion of negotiations, best and final offers are requested from those remaining within the competitive range and a contract is awarded to the apparent winner based on price and other factors. [Ref. 13]

b. SMALL PURCHASE SYNOPSIS

A requisition classisfied as small purchase synopsis is passed from the purchasing director to the individual buyer. Upon receipt, the buyer reviews the purchase requisition and prepares the synopsis. The purchase order is synopsized in the CBD for a minimum of 15 days. Upon completion of this period, the buyer contacts both the respondents to the CBD and qualified suppliers contained on the activity's BML. At this point, the buyer contacts at least three of the potential suppliers contained on their bidders list and request data for issuing an informal solicitation such as an RFQ. Based on the lowest price and criteria established in the purchase request, the buyer selects the best supplier and awards the contract. This contract must be awarded to a small or minority business if possible.

c. SMALL PURCHASE

A requisition classified as small purchase is passed from the purchasing director to the individual buyer. The buyer reviews the purchase request and selects from their BML the appropriate suppliers. At this point, the buyer contacts at least three of the potential suppliers contained on their BML and requests data for issuing an informal solicitation such as an RFQ. Based on the lowest price and criteria established in the purchase request, the buyer selects the best supplier and awards the contract. As in the case of small synopsis purchases, the contract must be awarded to a small, minority, or woman-owned business, whenever possible. [Ref. 13]

D. OBJECTIVES OF AUTOMATION

The primary objective of automation is to improve the effectiveness and efficiency of the currently tedious manual procurement process. Automation will improve responsiveness by reducing the time required to process an order as well as minimize the cost and effort involved. An automated system will provide certain specific advantages over a manual system such as:

1. Improved Procurement Administrative Lead Time (PALT).
2. Reduced document preparation time and effort.
3. Enhanced document tracking capabilities.
4. Provision for management information for internal and external reporting requirements.
5. Provision for a real time access to data.
6. Word processing capability to create contracts and implement changes to them.
7. Availability of various files such as price history files and Bidders Mailing Lists.
8. Improved contract administration and payment.
9. Provision for related systems interfacing. [Ref. 14: pp. 2.2-2.4]

E. APADE MOD 85 SYSTEM REVIEW

1. System Selection Decision

The reevaluation of the direction and status of NAVSUP procurement automation initiatives by the PATF in late 1984 and their subsequent recommendations provided the foundation from which the movement toward implementation of APADE was begun. The previous decision by the Supply Operations Review Board (SORB) in November 1983 to use Tandem hardware for SPLICE implementation coupled with DOD policy against sole source major procurements, narrowed the PATF alternatives to just three.

1. Continuance of the design and development by FMSO of the APADE system for use with Tandem hardware, and the ICP Purchase Resystemization Application for use on the ICP Resolicitation hardware.
2. Alteration and reprogramming of the U.S. Air Force's Base Contracting Automation System (BCAS) for implementation on Tandem hardware for both the NFCS activities and the ICPs. This alternative would require the use of APADE and ICP Purchase Resystemization concepts as guidance in adapting the BCAS system.
3. Reprogramming of the BCAS system to operate with the Resolicitation hardware at just one ICP, and linking all major NFCS activities to that system through communication lines. [Ref. 2: p. 10]

Presented with these alternatives, NAVSUP opted for the continuance of APADE design for the activities of the NFCS, and for the continued development of the ICP Purchase Resystemization Application for the ICP Resolicitation hardware. It was determined that such an effort could more effectively be tailored for use in the NFCS.

As the project cost would exceed the approval authority of the Naval Data Automation Command (NAVDAC), final approval was granted for a prototype installation with plans for a total of thirty-five sites implementation by the Assistant Secretary of the Navy for Financial Management in September 1985. Within just two years, the APADE project had increased in budgetary scope from a $23 million, 11 site effort, to one requiring $133 million for 35 sites in terms of life cycle cost. APADE was finally off the ground. [Ref. 5]

2. System Configuration

a. Hardware

Under current design concepts for the APADE project, its equipment is a set of peripheral devices supported by Tandem TXP hardware acquired in support of the SPLICE project. The APADE specific equipment will provide for both batch and on-line processing of the procurement applications. The following peripheral devices are required at the APADE site in varying quantities depending upon the size of procurement volume at the specific site.

1. Central Processing Unit capable of handling a minimum of 32 local and/or remote terminals.
2. Minimum of two magnetic tape drives with a 7-track or 9-track, 800 or 1600 bits per inch tape capacity.
3. Random access magnetic disk drives with a minimum 30 millisecond total access time. The drives capacity must be capable of initially supporting 200,000 records (200 byte) per file, and a maximum capacity of at least three times the initial amount.
4. Central high volume printers.
5. Remotely located laser printers.
6. Remotely located CRT terminals. [Ref. 6: p. 28]

b. Software

The operating system software will be provided by the SPLICE project and will allow for real time multiprogramming support. These operating systems will be from commercial sources and will provide on-line data entry, editing and error correction, terminal control, and updating and retrieval capability for files. The word processing operating system will provide for features including margin justification, search and replace, file maintenance, pagination, and tabulation.

Specific APADE application programs are being developed and will be provided by FMSO. FMSO will also provide the interfacing capabilities for APADE to function with external applications such as UADPS-SP, IDA, MILSCAP, SYMIS/MM, and others. [Ref. 6: pp. 28-29]

3. Functional Summary

Applications in the APADE system are categorized into seven functional areas that will be implemented in five distinct phases during the course of the APADE project. Table III summarizes the breakdown of functional areas and the phases of the project in which they will be implemented. The development of APADE will occur in five phases. Each phase will integrate a new application feature as those new features become avialable. A description of each phase is provided in Appendix C.

TABLE III

FUNCTIONAL AREAS OF APADE AND THEIR IMPLEMENTATION PHASES

Functional Area	Phase(s)
Requisition Input/Update Processing	1,2,3
Pre-Award Processing	2,3,4,5
Award Processing	1,4,5
Contract Management Processing	3,4,5
Inquiry Processing	1,2,3,4,5
Report Processing	1,2,3,4,5
System Management Processing	1,2,3,4,5

Source: [Ref. 15: p. 1]

a. Requisition Input/Update Processing.

In this functional area, the initial step of the procurement process begins with the receipt of a requisition from a customer. Requisition input to APADE will be accomplished either manually or automatically through interfaces with either UADPS-SP or the SYMIS/MM systems. Manual input will be made by input clerks or buyers from remote terminal sites using user friendly, menu driven CRT displays. Data entries will be automatically edited for correct format and content.

From the Requisition Input screen, the operator will have the options to group requisitions, use specially tailored requisition input screens, and to print a PR Data Sheet. The PR Data Sheet will be the workhorse of the buyer by providing from a high speed dot matrix printer in batch mode, a five page working document summarizing:

1. Number and value of requisition on PR.
2. Potential combination information.
3. Equivalent item information.
4. Price history information.
5. Commercial source information.
6. Requisition information including quantity, unit of issue, nomenclature, unit price, commodity code, total item value, and accounting information. [Ref. 14: pp. 3.9-3.16]

From the Requisition Update screen, the operator will have the opportunity to make buyer code updates in the event a PR changes hands among responsible buyers. They will be able to initiate both full and partial cancellation actions in the update mode. Additionally, the operator will have the capability to combine PRs of similar procurement action, as well as split a PR in the event that dissimilar or inappropriate groupings of line items appear on a single PR. Finally, the operator will be able to make general modifications, additions or deletions of information, or simply review PRs from the Requisition Update screen. [Ref. 14: pp. 3.16-3.19]

b. Pre-award Processing

At this point, a manual review of the PR data must be made by a buyer to determine the appropriate method of procuring the listed material or services. This review may be made from the CRT. Once the method of procurement has been established, the buyer can use the Pre-award function to accomplish several tasks.

(1) Referrals. Here, the buyer can refer a customer requisition to another activity electronically from the Referral Issue input screen. This function will validate all requisition data for accuracy and completeness. Required corrections will be cued to the buyer. The system will have an interactive word processing system to allow completion of any text requirements, and will be capable of printing letters or messages for transmittal. Referral responses will be entered to update records indicating that the requisition has been acted upon.

(2) Milestone Plans. This function allows the buyer to set up and review/update a milestone plan for a procurement action using either a preestablished plan generated by his NFCS activity, or create a unique plan by modifying a preestablished plan or generating an entirely unique plan by keying in required data. If necessary, the system is capable of replacing an existing plan under an active procurement request with a new one.

(3) Preaward Documentation. An interactive word processing capability will be used to create a variety of documents for the preaward process. Documents such as the Report of Contract Profit Plan (DD1499), Contractor Pricing Proposal (SF1411), Preaward Survey of Prospective Contractor (SF1403), Report of Letter Contract (NAVMAT 4330/27), etc. can be generated with appropriate data automatically updating the database, and those documents whose

responses require tracking are keyed. Responses to preaward documentation will be input to the system in a manner similar to the referral response procedure.

(4) Informal Solicitations. Issuance of an informal solicitation such as a Request for Quotation (RFQ) can be initiated in this functional segment. The system will assign the appropriate RFQ number and prompt the user for the information necessary to generate the RFQ. The user will designate a list of sources to be solicitated, and will be provided a Bidders Mailing List (BML), if necessary, from which to work. The BML will be generated by a database that will keep track of all sources solicited, indicate the last successful bid, and any additional input deemed appropriate. If an operator chooses to solicit a firm that does not meet set-aside provisions or is on the Consolidated List of Debarred, Ineligible or Suspended Contractors (JCL), an error message will be generated from the system notifying the user that the chosen firm cannot be solicited. This function will also allow for notation for responses from informal solicitation, and can generate listings of firms responding.

(5) Presolicitation Notices (PSN). The generation of a PSN may be made as the first step in a negotiated procurement action to develop and identify interest among potential sources. This process will proceed much like that for informal solicitation, ensuring that firms meet set-aside provisions, as necessary, and that they are not currently listed on the JCL. Responses can, again, be notated for those firms responding. Additionally, the system will purge the files of those firms failing to respond for that material/service.

(6) Formal Solicitation. The system will assign a solicitation number and an opening/closing date if desired by the activity. The system will prompt the operator for the required data, and will determine if synopsis in

the Commerce Business Daily (CBD) is required. All correct data must be entered in order to proceed. If a PSN has been initiated prior to this solicitation, the system will determine the Federal Supply Code of Manufacturers (FSCMs) from the BML to determine the recipients of the Formal Solicitation. If a PSN was not issued previously, the system will generated a recipient listing from the BML, allowing for any set-aside provisions and FAR regulations. Response data may be entered as it is received, and an Abstract of Offers (SF1409) generated.

(7) Amendments to Formal Solicitation. By providing the required data, the operator can update records to reflect the existence and the content of an amendment. The system, through interactive word processing, as necessary, can generate amendment documents. Responses to amendments can also be filed.

(8) Bidders Mailing List Updates. The operator may access the BML for updating, and this is required during the solicitation process for all firms that requested a copy of the solicitation. The system will ensure that a duplicate entry is not being made, and that the firm does not appear on the JCL. In either event, an error message will notify the operator of the problem. [Ref. 14: pp. 3.19-3.31]

c. Award Processing

Both small and large purchase will be supported under this function. In it, the buyer will be able to enter award information and generate contract award documentation from laser printers. The system will support awards made through a variety of contract types as listed below.

1. Blanket Purchase Agreement (BPA) Calls.
2. Imprest Fund. (no documents)
3. Unilateral and bilateral purchase orders.

4. Delivery Orders (D/O).
5. Release of Automated Delivery Orders.
6. Large Purchase Awards.
7. Negotiated Bilateral Contract and updates.
8. Basic Contracts/Agreements.

In support of the actual award categories, the Basic Contract/Agreement File will be tailored to each APADE site and can contain information concerning locally established contracts and agreements and information about those contracts and agreements established by other activities but may be used locally. This file can also contain information concerning Federal Supply Schedules established by Federal Prison Industry, National Industries for the Blind, National Industries for the Severely Disabled, and the General Services Administration.

Additional features under some of the large purchase award categories include electronic production of Contract Administration Letters, Contract Administration Plans, CHINFO news releases, and Synopsis requirements. [Ref. 14: pp. 3.31-3.40]

d. Contract Management Processing

This function of APADE allows for post-award contract administration. It provides for the establishment and monitoring of Milestone Plans (M/S) that can be either pre-established or unique, as in the Preaward Processing function. Individual milestones can be defined by the procurement activity. Under this segment, M/Ss can be replaced or updated as necessary.

Post-award contract modifications can be made under this function per the instructions provided to the system by the contract administrator. The system will produce those contract modifications and conduct the database updating that may be a result of such modifications. Based upon the newly entered data from the modification, the system will determine its impact with regard to the FAR, and determine if new CBD synopsis, CHINFO news release and/or DD350 are required as a result. If so, they will be generated. Modifications produced outside of the APADE environment will be able to be recorded within the system's data files.

In the event that a customer requisition requires referral after the award of contract, files may be updated with such information. There is also provision to annotate response to such referral action.

Through the interactive word processing system, a wide scope of post-award documentation can be prepared. Additional features of this function include, contract closeout and closeout documentation generation. [Ref. 14: pp. 3.40-3.47]

e. Inquiry Processing

As an on-line system, APADE allows for immediate access to its files in the database which include active records, completed or cancelled records (skeletonized information) and all system support files. Skeletonized information refers to the reduced volume of data elements for each purchase action held for historical purposes. There are four general categories of inquiry.

(1) Status Inquiry. As its name implies, this subfunction of Inquiry Processing allows the operator to determine immediately, the current status of a purchase action with reference to its requisition number,procurement request number, solicitation number, or contract number. Status is displayed on the CRT terminal, and the operator has the option of printing it. Printing options allow for the generation of letters, memos, messages, or simple CRT screen format.

(2) Folder Inquiry. Call up of a purchase action in this subfunction will produce a simulated purchase folder in screen readable form. The folder will contain information concerning requisition and PR data, post-award data, bid list information, amendments, and milestone data.

(3) Ad Hoc Inquiry. This subfunction simply provides for the direct access to the system's on-line data base.

(4) Support File Inquiry. Support files are established as necessary by the APADE activity and may include such files as price history, commercial source listings, contract clauses, personnel files, etc. [Ref. 14: pp. 3.47-3.51]

f. Reports Processing

This function provides the APADE system with the capability of producing internal and external reports as well as statistical data for the Uniform Management Report. Reports will be provided in hardcopy from system printers. In addition, APADE will provide the capability to transmit DD350 reports between the data bases of the APADE site and NAVSUP electronically via telecommunications media. [Ref. 14: p. 3-53]

g. System Management Processing

Available in this functional area will be file maintenance capabilities, a user assistance package, and a Computer Assisted Instruction (CAI). File maintenance will be available to security authorized personnel to access any of the APADE system files. Files will periodically be skeletonized (after closeout) to retain pertinent data with the full file being transferred to archival storage. Skeletonized files will also be purged periodically to remove those files which have fully served their purpose.

The user assistance package or HELP Directory, will provide on-line access to a listing of all data elements used in the APADE system with their respective definitions.

The CAI package will provide step-by-step instructions for procedures such as log-on, access to SPLICE, APADE, and subsystem menus, methods of input to CRT screens, and making corrections. [Ref. 14: pp. 3.53-3.55]

h. Security

While not a specific functional area of APADE, security is, nonetheless, an important point of note. As access to some of the information tracked by APADE can be considered sensitive (i.e. proprietary data), the role of security is a major issue.

Security is to be controlled by the assignment of personal alphanumeric codes to buyers, contract officers, input clerks, and any other personnel given access to the APADE system. Each APADE site will be programmed to provide access to each of its functional and subfunctional areas only to specified identification codes. The importance of this feature is quickly realized when considering that the contract officer's signature is digitized into the system, and that release of an award can come directly from the computer system when given the appropriate coding. Access codes will be changed at intervals deemed necessary to ensure the integrity of the system's security.

4. Training

Such a comprehensive system will require a high degree of dedicated training throughout both the implementation of the system as well as throughout the APADE life cycle. In dealing with this anticipated need, NAVSUP developed the Navy's APADE Training Team (NATT) through the

Employment Development Division of the Naval Supply Center, Norfolk, Virginia. This organization is responsible for both developing the training program and conducting actual training. Operational training consists of actual "hands on" learning in a buyer environment, interacting with an actual training data base.

The training program has been effectively developed by the NATT staff, and provides for specific functional area training programs ranging in length from two days to two weeks. Most impressive is the professional concern to "certify" users through the use of end of training comprehensive examination. This practice will ensure competence before a user can make his first keystroke.

A thorough library of teaching materials has been developed as both instructor and student training guides to cover each of the functional areas of APADE. In addition, a unique teaching practice of televising instructor keystrokes at each student station during lessons has helped enhance the learning process. Discussion with students on site at the training facility indicated that the training was both effective and well received.

The potential pitfall looming in the future is the restricted capacity of the training facility. Only ten students can be trained at any one time, and there are a substantial number of procurement personnel to train as APADE implementation gets underway. Consideration is currently being given to opening another training facility on the west coast. Actualization of the second training site would help ensure continued professionalism through certification as the personnel requirements for the system accelerate. [Ref. 16]

5. Current Status

On April 3, 1986, APADE went on-line at the Naval Air Rework Facility (NARF), NAS, Norfolk, as a part of the NSC Norfolk APADE organization. The first contract award and associated documentation was let on April 4, 1986. Initial response to the system has been good from both users and supervisory personnel.

Like all new systems, APADE has experienced some minor difficulties during its initial implementation. These problems have dealt with slow terminal response time, lack of proper coding to operate the local laser printers, and terminals waiting for trained buyers to use them. In relation to the overall scope of the APADE system project, these initial problems are simply minor inconveniences, and are well on track to correction.

A potentially major setback exists in that the initial contract award for the terminals for the APADE system (awareded to Integrated Systems Group of Federal Computer Corporation for IBM PC and associated emulator software) has been successfully protested by Tandem Corporation.

Economically, planned installation of APADE at the thirty-five large NFCS activities is expected to provide a net savings/benefit of $242.3 million to the Navy.

> Deployment of APADE to 35 installations has a total present-value cost of $95.6 million. Over the life of the system, APADE is expected to generate present-value savings or benefits to the Navy of $337.9 million. [Ref. 6: p. 2]

6. The Future

With expanded use and increasing user interaction with the system, APADE can be expected to be continually refined in terms of both capability and user friendliness.

Project goals, if met, will have the entire implementation of the thirty-five sites completed by January 1990.

Beyond this initial APADE implementation, means to achieve an APADE networking system among the sites is now in a conceptual stage of development. Future creation of the Functionally Enhanced Navy Integrated Contracting System (FENICS) will provide system-wide availability of important contracting information.

> The purpose of FENICS NET is to take the information available on price history and potential sources in each of the thirty-five APADE sites and make it available to every APADE buyer world-wide. Instead of only having the price history and sources known to the one procurement office, the buyer will now have access to Navy-wide information. In addition, procurement managers will be able to review system-wide procurement information. The potential savings attributable to such a capability are enormous compared to the cost. Because the system will be able to take advantage of the SPLICE communications environment and the APADE data base, additional hardware costs will be relatively small. [Ref. 17: p. 1]

Implementation of APADE, and ultimately the FENICS NET, will strongly support the utilization of opportunities directly affecting the achievement of critical success factors in pursuit of the goals of the Naval Supply Systems Command. Critical success factors directly affected include Supply Response Time, Productivity and Procedural Discipline, Quality and Cost of Material and Services, and System Integration and Data Accuracy. [Ref. 18]

III. THE SMALL CONTRACTING FACILITY

A. DEFINITION OF THE SMALL CONTRACTING FACILITY

Within the context of this research report, a small contracting facility of the NFCS will refer to all those activities not included in the initial implementation schedule for the APADE project. This framework will be used because it is these activities for whom the question of automation has not yet been properly addressed.

There are currently 868 of these activities that are within the NFCS. While they account for nearly 50% of the total number of procurement actions for the Navy, they account for only 9% of the Navy's total procurement dollar volume.

Small NFCS activities can be further categorized as being either Major Field Contracting Activities, or Minor Field Contracting Activities. Major NFCS activities derive their purchase authority directly from NAVSUP, while minor activities derive their contracting authority from cognizant regional contracting offices. These regional offices are included among the large NFCS activities discussed in Chapter II. [Ref. 7: p. 1-3]

B. SCOPE AND RESPONSIBILITY

1. Major Field Contracting Activity

These activities are designated by NAVSUP and are granted purchase authority generally ranging from $10,000 to unlimited dollar values, depending upon the activity's assigned mission and support responsibility. These major activities are given specific responsibilities that place them in further subcategories.

a. Central Buying Activities

> It is the policy of NAVSUP to centralize buying, by region area and commodity to the maximum extent practicable. The advantages gained through the specialization of functions, centralization of buying skills, increased knowledge of and familiarity with sources of supply and economy of quantity buying are the primary bases for centralized buying. [Ref. 7: p. 1-5]

The centralized buying practiced by NAVSUP includes regional, area, and commodity purchasing. Regional buying activities are responsible for procuring those materials assigned to NAVSUP for management, and for making purchases that are beyond the purchase authority of those other NFCS activities within the area served by the regional buying activity. These activities are generally quite large (most are designated APADE sites) and have further responsibility to prepare and distribute bulletins concerning term contracts for use by other activities, provide contractual assistance and contract planning to activities within their respective regions, and provide other such services as deemed necessary by NAVSUP. [Ref. 7: p. 1-5]

To provide centralized buying capability close to the customer, NAVSUP designates area buying activities to subdivide the larger regions. These activities generally have a smaller purchase authority than the regional buying activities, but can still provide procurement service to those activities within their assigned areas who require material or services in excess of their purchase authority. [Ref. 7: p. 1-7]

Commodity buying activities are considered large activities or Inventory Control Points (ICPs) for the purposes of this thesis. They will receive APADE or the ICP's Purchase Resystemization. These activities such as the Navy Aviation Supply Office (ASO), Navy Ships Parts Control Center (SPCC), and the Navy Resale and Services Support Office (NAVRESSO) are responsible for procuring stock requirements and stock replenishment for material under centralized inventory control. [Ref. 7: p. 1-7]

b. Noncentral Buying Activities

Provided with purchase authority directly from NAVSUP, these activities are responsible for the procurement of materials and services in support of their parent command and its mission. [Ref. 7: p. 1-8]

c. Limited Buying Activities

These activities are provided with transactional limits with which to exercise purchasing authority. NAVSUP promulgates precise limitations of scope for these NFCS activities through individual letters of contracting authority. Such limitations can be either monetary, requirement type, or both. The following activity types fall into the Limited Purchase Authority category:

1. Commissary Stores.
2. Naval Reserve Officer Training Corps units.
3. Aviation activities maintaining supplies of flight packets.
4. Naval Health Sciences Education and Training Command, Bethesda, Maryland. [Ref. 7: p. 1-9]

2. Minor Field Contracting Activity

Those naval shore activities that do not have NAVSUP granted purchase authority may be granted authority for direct procurement to a transactional limit of $2,500. Such authority is granted by the cognizant regional contracting activity to help small activities maintain some level of flexibility in their operations. Authority may be extended to $5,000 for certain reserve personnel support functions. Any authority granted may be limited to only certain transaction types. [Ref. 7: p. 1-9]

In all cases of field purchasing authority, the activity granted such authority is responsible for the proper handling of government resources and for following established guidelines for their use.

C. REQUIREMENTS FOR AUTOMATION

With only thirty-five contracting facilities scheduled for receipt of comprehensive automation through APADE, there remain 868 activities that will continue to be saddled with the burden of manual or non-standard automated processing of procurement actions. During fiscal year 1985, these activities accounted for 49.19% of total Navy procurement transactions and 9.06% of the total dollar value of those total transactions as seen in Table II.

A structured survey of a sample of forty of these non-APADE facilities was conducted by the authors to determine the small activity's perceived needs for automation. The questions used in the conduct of this survey are found in Appendix D. They were posed to a cross-section of facilities represented by varying purchase authority, command type, geographic location, and claimancy. Facilities whose purchase authority was more than $1,000 tended to indicate large transaction volume and an associated inherent need for automation. Those facilities whose purchase authority was $1,000 or less, generally indicated procurement actions of low volume and low value, and expressed the need for very limited automated capability, if any.

The requirements for automation of the small contracting facility therefore vary and can be reviewed most readily in two distinct categories defined by purchase authority.

1. Purchase Authority of $1,000 and Below

a. Summary Description of Operations

The NFCS activities in this category (NROTC units, reserve centers, Navy liaison offices, support detachments, etc.) provide purchase capability to small and remote naval organizations. Their purchase authority is granted by regional contracting centers to provide flexibility in the support of operations of those remote units. The purchase activity of these facilities typically consists of less than 500 transactions valued at under $100,000 each year. The 577 activities falling into this category account for 11.74% of total Navy procurement actions and 2.27% of the total dollar value of Navy-wide procurement. [Ref. 19]

Typically operating as one buyer NFCS sites, procurement processing and reporting are accomplished manually at these activities. Price history information is pulled manually from historical files as may be necessary. Contract solicitation and award is generally conducted verbally for these extremely small purchases. Due to their low transactional volume, PALTs are relatively low (1-2 days), and there are very few processing backlogs. Requisitions exceeding local purchase authority are passed to area buying activities for processing, and are few in number. Reports are manually generated in an accurate and timely manner because low transactional volume provides for easily accessible and manageable data.

b. Automation Needs

Based upon a review of the procurement activity reported by this sample and procurement statistics available, the need for automation of the procurement process at this level appears to be negligible. In fact, the majority of respondents in this category of the survey expressed a distinct lack of desire for automation at their facilities. A typical response when asked if they would like to see procurement automation at their level was, "Yes, but in reality, no. There is not enough volume or dollar value to constitute automation. This is only a three man operation." [Ref. 20]

There was a consensus among the higher volume facilities within this category that a need existed only for word processing capability to more efficiently generate procurement documentation and reports. [Ref. 21]

2. Purchase Authority of Above $1,000

a. Summary Description of Operations

These NFCS facilities are granted purchase authority from NAVSUP to support local missions and to act as area buying activities for smaller NFCS components, when so designated. Purchase authority granted varies widely within this category, ranging from the $2,500 authority of NFCS sites such as Naval Air Station, Kingsville, Texas, to the unlimited authority of the Naval Administrative Command, Great Lakes, Illinois. These 291 activities, during fiscal year 1985, were responsible for 37.45% of total Navy procurement transactions, and 6.79% of Navy-wide procurement dollar value. Volume of individual facilities within this category are measured in hundreds of actions per week, for annual procurement values measured in millions of dollars. [Ref. 19]

While there are some very limited automated tracking and document preparation systems in use at several of these facilities, purchase processing is largely a manual process. Any existing automation tends to be locally developed data bases and word processing applications initiated as an attempt to alleviate the ever-increasing transactional volume and associated backlogs. PALT for these activities typically ran at 21 days or more, and was increasing. This additional backlog was partially due to personnel shortfalls experienced as a result of the Secretary of the Navy civilian hiring freeze instituted in March 1986 in response to the Gramm-Rudman Act [Ref. 22]. However, even at full manning, these activities reported backlogs and PALT in excess of the seven days achievable through the use of APADE.

Data bases for tracking, reporting, and for reference to historical pricing/vendor data are inadequate or non-existent for most activities. Considerable time is required to perform the previously outlined process of solicitation, document preparation, and contract award. The lack of accessible data bases limits the use of historical price data to only the largest of purchase requests, and even then is often unavailable. Without such information, the evaluation of a fair and reasonable price becomes marginal with three bids and impossible with high volume sole source contracts. This concern was voiced strongly by field contracting officers who believed that the lack of competitive bidding for purchases of less than $1,000 value, and inadequate time for thorough review of such purchase actions, was the predominant cause of recent adverse publicity concerning Navy procurement efforts [Ref. 23].

b. Automation Needs

> I would like to see a system that has a terminal on every buyer's desk, to provide them with immediate access to needed information and document production capabilities. This would better serve our customers and ourselves. [Ref. 24]

This comment fairly represents the attitudes of the contracting officers involved with purchasing activities with greater than $1,000 authority. All claim a sincere and immediate need for better automation or simply initial automation implementation. This requirement is further endorsed by such higher levels of operational authority as Commander, U.S. Naval Air Forces, Pacific (COMNAVAIRPAC):

> Present emphasis on improved purchase procedures and controls mandates activities with significant purchase volume seek methods to improve the process. An automated purchase system is required to offset personnel and funding resource constraints. [Ref. 25]

As can be seen by these statements and the continued appearance of procurement debacles in the news media, it is quite apparent that the requirement for automation at these activities is very real. Manual procurement processing systems are responsible for ever-increasing PALTs and the associated backlogs in processing. The continued reliance upon a largely manual procurement processing system can only accelerate the problems that it generates.

Documented requirements have been stated through COMNAVAIRPAC in his efforts to acquire increased automation capability for procurement at naval air facilities on the west coast.

> The following characteristics/functions should be included:
>
> 1. Interactive shared data base with CRT terminal on each buyer's desk for record update and inquiry.
> 2. Ability to search data files by part no., or nomen for price history and vendor source history over 2 year period.
> 3. Prepare delivery order and purchase order documentation.
> 4. Calculate and print all purchase reports.
> 5. Provide limited purchase input/inquiry from remote on base customers. [Ref. 25]

Additional requirements voiced by contracting officers during the survey of these activities included:

1. Improved tracking of purchase requests on a real time basis.
2. Improved document generation turnaround time so that smooth copy documents can be provided earlier.

3. Financial data base accessibility to ensure funds are available for obligation.
4. Ability to rapidly modify and/or update procurement processing actions or documents as needed.
5. Ensure adequate training and user friendliness to expedite productivity upon installation.

It is apparent that the potential benefits to be derived from the automation of these activities are attractive and may be as significant as those attained through the implementation of APADE at the large contracting activities. The automation of these activities will hinge upon the identification of a cost-effective system capable of providing for the automation needs of the small NFCS activity.

D. ALTERNATIVES FOR AUTOMATION

The Secretary of the Navy policy concerning the development of new ADP systems to be implemented where manual systems are currently in operation is quite clear. It specifically calls for the evaluation of available military or commercial ADP systems, and their possible modification, to meet the need [Ref. 26]. The evaluation of existing Navy automated procurement systems to fulfill the automation requirements of the small contracting activity provides for the initial step in complying with this directive. The viable alternatives currently in use within the NFCS environment include APADE, the Automated Procurement Tracking System (APTS), and the Automated Aquisition Module (AAM).

1. APADE

The APADE system was thoroughly described in Chapter II. This system provides for a user friendly environment that will satisfy all small activity automation requirements. Implementation of this system is possible through telecommunication links via SPLICE from remote locations to centralized sites possessing APADE hardware and software.

2. APTS

The Automated Procurement Tracking System is a procurement application developed by Omega Computer Systems, Inc. and is currently in operation at NSC San Diego and NSC Charleston. The application runs on a Wang VS computer with access from remote terminal locations.

While capable of automating both the large and small purchase processing procedures, this system is particularly well equipped to provide support for small purchase actions. Consisting of programs and data files that store and manage procurement information, APTS tracks purchasing actions, generates internal and external reports, and provides for electronic preparation of procurement documents. Further, it has been designed to be in full compliance with existing procurement regulations and directives. [Ref. 27: p. 4]

Processing through APTS is conducted by menu driven interface with clerks, buyers, contract specialists, managers and possibly even customers. Requisition inputs can be accomplished by keystroke or through automated interfaces with either UADPS-SP or SYMIS/MM tapes. Through the manual keystroke data entry method, the input clerk or buyer provides single line requisition data from the customer. If entered by an input clerk, a supervisor may manually assign the purchase action to an individual buyer. APTS validates all input data and ensures required data are provided by alerting the operator to any mandatory entries that may be missing. The requisition data is entered to the data base, and a standard preaward milestone tracking plan commences.

During the preaward phase of the procurement process, APTS allows for requisition modification or cancellation, can provide (upon request) a BML with respect to commodity, and can generate RFQs through the use of an inherent word processing application. Manual entries are required to update status and record actions pertaining to the requisition. The buyer must evaluate responses and make an award decision. Once the award decision is made, the APTS application can again be used to generate award documentation on Form DD1155s for small purchase.

There is very limited capability for contract administration in APTS. No milestone plans are available, and receipt of material/services must be recorded manually. Lacking, also, is a comprehensive data base providing an adequate pricing history.

APTS will generate the external DD1057 report of monthly small purchase action. The system has the capability of generating user defined internal reports, as well. [Ref. 2: Appendix C]

Additional features and improved application design are available with Omega Computer Services, Inc.'s latest version of APTS called the Automated Procurement Production and Management System (APPMS). This upgraded version of APTS is written in current fourth generation computer language as opposed to the cumbersome COBOL file structure of APTS. Enhanced features of APPMS include a comprehensive FAR clause bank, on-line Help screens and instant reference documentation, and milestone planning for contract administration. Consideration of APTS as an alternative for automating the small NFCS activity will incorporate the use of APPMS application software.

The most advantageous features of the APTS/APPMS alternative in its application to small purchase oriented activities include:

1. Menu driven and user friendly.
2. Generation of purchase documentation.
3. Generation of external reports.
4. Customer inquiry capability.
5. Real time access to procurement status.

6. Means to modify and update actions/documents.
7. Availability of BML for use in processing.
8. On-line instruction and reference documentation.
9. FAR clause bank accessible by contract types.
10. CBD synopsis template and available telecommunications interface.

3. AAM

The Automated Acquisition Module is a subsystem of the Industrial Logistics Support Management Information System (ILSMIS) initiated by NAVSEA in support of its large ordnance facilities. It is currently operational at nine such activities represented in Table IV. The application module is designed "to provide a significant commercial purchasing function in support of their missions" [Ref. 28: p.1-1].

As made apparent in Table IV, the AAM has been in service for a significant period of time, and has been well received by ordnance facility contracting personnel [Ref. 29].

As a potential stand alone module, AAM supports ILSMIS on the Honeywell DPS-8 computer. The central processing unit can be used from remote locations through the use of Honeywell VIP 7760 or compatible terminals. Each of the nine sites using this application has its own hardware/software resources.

The AAM is segmented functionally into four submodules, each serving a distinct aspect of the acquisition process. The first segment is concerned with processing and maintenance of procurement actions. In this segment, once requisitions are input by the technical research branch,

TABLE IV

Automated Acquisition Module Activities

Activity	Implementation Date
Naval Weapons Support Center Crane, Indiana	3 January 1984
Naval Weapons Station Yorktown, Virginia	13 February 1984
Naval Ordnance Station Indian Head, Maryland	13 February 1984
Naval Weapons Station Concord, California	19 March 1984
Naval Undersea Warfare Engineering Station Keyport, Washington	19 March 1984
Naval Weapons Station Charleston, South Carolina	23 April 1984
Naval Ordnance Station Louisville, Kentucky	23 April 1984
Naval Weapons Station Seal Beach, California	28 May 1984
Naval Weapons Station Earle, New Jersey	28 May 1984

Source: [Ref. 28: pp. 3.7-3.8]

buyer assignments can be made automatically based upon current workload, requisition priority, backlogs, or may be manually overridden for direct assignment by supervisors. The system also takes into account the possibility of combining requisitions for a single procurement action. This module maintains statistics through data files relating to buyers, procurement status, and product history. The Product History File provides a summary of the previous five purchases or three years history, whichever is less. Receipts can be entered manually to the system to complete the post-award phase of the transaction. Finally, this segment will assign activity controlled sequential numbers for solicitations, contracts, and orders/calls. All procurement actions will be cross referenced by these numbers and the requisition number. [Ref. 30: p. 1]

The second segment of AAM maintains the vendor file and bidder file. These files are historical data files that accumulate vendor and bidder information from actual procurement transactions. Each bidder/vendor is assigned a commodity code and is logged with information concerning its applicability to small business, 8A set-aside, and disadvantaged business characterization. These files are drawn on to provide BMLs during purchase processing. The system provides for automatic rotation (to screen for small business qualifications) of vendors within each commodity code. Bidders/vendors who do not respond to preaward solicitations on two consecutive occasions are dropped from the data base. Vendors providing unsolicited bids or responding to CBD Synopsis are manually added to the files. This segment has the unique feature of providing mailing labels printed directly from the automated BML. [Ref. 30: p. 2]

Segment three of the AAM contains the document maintenance and form generation applications. Documents for preaward actions, as well as for actual contract award, are developed from user-friendly menu-driven CRT presentations. Once an award document type is selected, the system draws information from each of its data files pertaining to the action in question, and displays the information on the buyer's terminal. Clauses pertaining to a particular document type are listed by number for appropriate selection. The buyer may also assign clauses not listed but deemed necessary. The documents available for electronic generation are listed in Table V. [Ref. 30: p. 2]

Finally, the general system segment is used to maintain information that is unique to installations. Information such as the Unit Identification Code (UIC) and buyer codes are included. [Ref. 30: p. 3]

The features of AAM that are most significant in meeting the automation needs of the small procurement activity are:

1. Menu driven and user friendly.
2. Procurement processing document generation.
3. Real time tracking capability.
4. On-line BML and contract clause selection.
5. Interfacing with financial data bases.

TABLE V

Documents Generated by AAM

- Request for Proposals
- Requests for Quotation
- Purchase Orders
- Blanket Purchase Agreements
- Contract Modifications
- Invitations for Bid
- Contracts
- Delivery Orders
- Basic Ordering Agreements
- Solicitation Amendments
- Rejection of Proposal
- Authority to Negotiate a Cost Plus Fixed Fee Contract
- Authority to Negotiate an Individual Contract
- Pre-award Notice of Unacceptable Offer
- Solicitation of Best and Final Offer
- Notice of Contract Termination - Default
- Consideration of Contract Termination - Default Warranties
- Request for Review and Evaluation of Technical Proposals
- Duty-Free-Entry Certificates
- Possible Mistake in Quotation

Source: [Ref. 30: pp. 2-3]

Additional systems in use at NFCS activities that were reviewed for potential implementation NFCS-wide included the Automated Status of Purchasing Information Recorded Electronically (ASPIRE) in use at NSC Puget Sound, the MOHAWK system in use at the Naval Submarine Base, Groton, and the Xerox Star system being operated at SPCC. While these systems provide for a modicum of procurement process automation, they are each severely limited in scope and fall short of providing for any significant portion of the small procurement activity's needs. Each is largely a document generating system unable to provide the benefit of on-line procurement management information.

E. ALTERNATIVES TO BE ANALYZED

It would appear that the exportation of APADE throughout the NFCS would be the most logical extension of procurement automation. This is due to its implementation at large activities with features providing complete coverage of the small activity's automated needs. However, APADE provides several features beyond the requirements of the small activity. Thus, while it proved most cost effective at large procurement activities, it may prove less cost effective than the best alternative when the scope is broadened to encompass a much larger array of activities. APADE is the most comprehensive alternative available and, therefore, must be considered for implementation throughout the NFCS.

Both APTS/APPMS and AAM consist of features that would provide a significant contribution toward the automation needs of the small procurement activity. While AAM has enjoyed success at its activities due to its many useful features, there are several drawbacks associated with it that inhibit its exportation to other NFCS activities. First, the AAM was developed as an additional module for an already existing information system in use by the ordnance facilities. Therefore, AAM was tailored to fit a restricted environment, relying on support from the ILSMIS system. Exportation of AAM to a non-ILSMIS automated environment would require extensive redesign of the current application package at a considerable cost of both time and tangible resources. Second, while the AAM system is relatively user-friendly, the formalized training necessary to expand its use throughout the NFCS is not currently available. Training at the installation visited was conducted informally by the most experienced personnel in an on-the-job type environment. This training was effective, but without formal training programs and system documentation, the rapid increase in AAM knowledgeable personnel that would be called for by NFCS-wide implementation would be impossible. Finally, the current installation of AAM was initiated to improve procurement productivity and tracking in response to adverse findings of system audits. The system implementation was conducted with minimal attention to cost ramifications other than requiring the use of existing hardware. Although the resulting payoff of AAM has not been thoroughly analyzed, and detailed costing information was not available, a current appraisal is that "it has not been cost-effective" [Ref. 31].

Due to the drawbacks just discussed, APTS/APPMS provides the next best alternative to APADE for use in the possible automation of the procurement process at small procurement activities. Therefore, the cost-benefits of implementing each of these alternative systems must be determined and analyzed to establish which, if either, is the more appropriate approach. In addition, due to the clear distinction between activities requiring automation based upon purchase authority, the cost-benefit analysis for each system must be further segmented to determine to what level in the NFCS these systems may be effectively implemented.

In summary, the five alternatives to be considered through cost-benefit analysis are:

1. Implementation of APADE NFCS-wide.
2. Implementation of APADE at NFCS sites with purchase authority of greater than $1,000.
3. Implementation of APTS/APPMS NFCS-wide.
4. Implementation of APTS/APPMS at NFCS sites with purchase authority of greater than $1,000.
5. Maintain the present system.

IV. COST-BENEFITS OF LINKING TO APADE

A. BASIS OF THE ANALYSIS

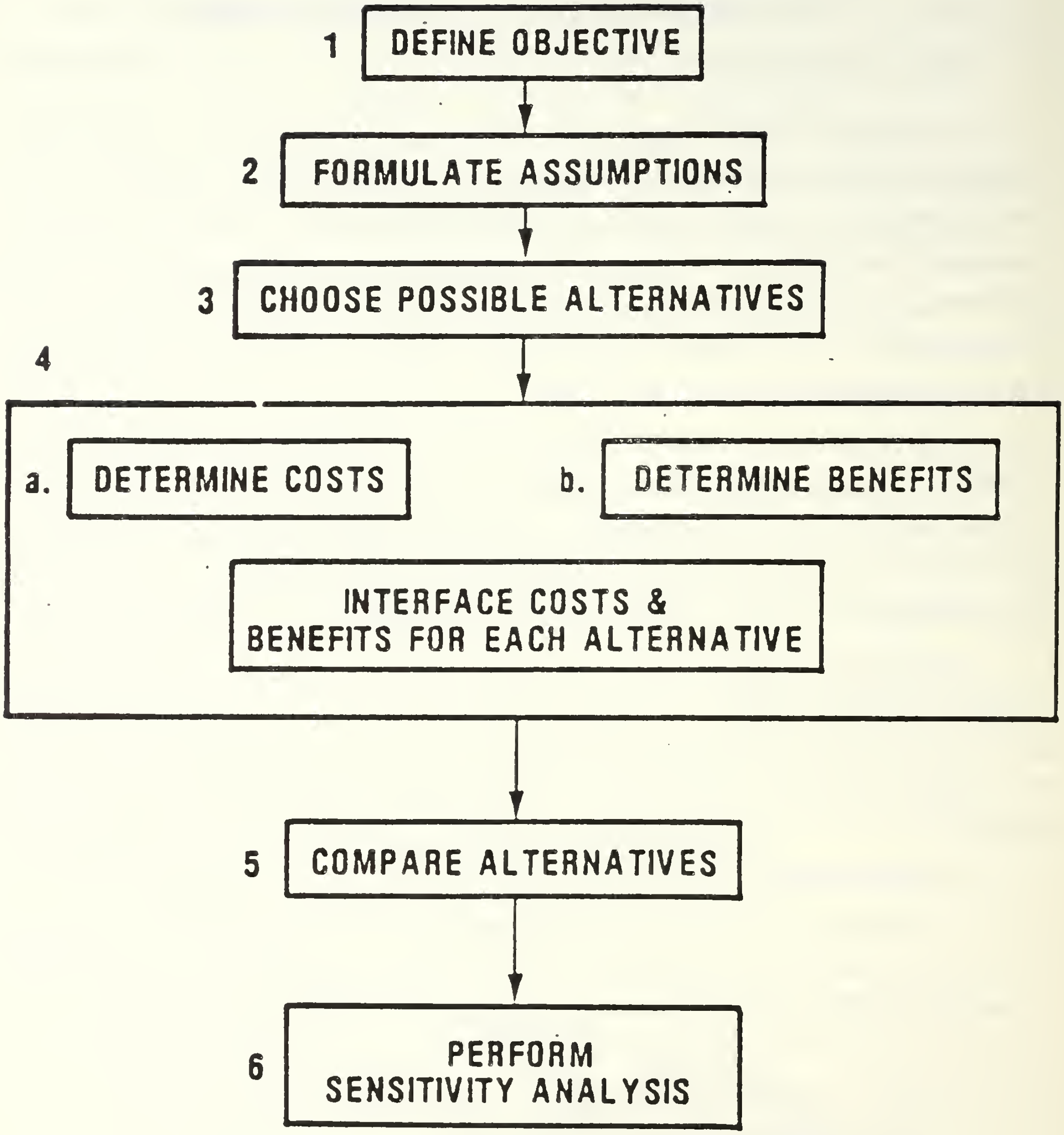
Guidance for the cost-benefit analysis of the effort to automate the small NFCS activities is provided through the requirements established in SECNAVINST 7000.14B concerning economic analysis of new and established Navy programs. The performance of this cost-benefit analysis was conducted in accordance with SECNAV guidance using the format illustrated in Figure 4.1.

Step 4 of the process outlined in Figure 4.1 will be segmented by alternatives being considered. Those alternatives involving APADE are included in this chapter. The alternatives pertaining to APTS are discussed in Chapter V. The comparison of alternatives is presented in Chapter VI.

1. Objectives

The objectives to be achieved by the automation of the small contracting activities were presented in detail in Chapter III. In review, the primary objectives included:

1. Automatic preparation of procurement documents.
2. Improved tracking of procurement requests.
3. Automatic preparation and printing of reports.
4. Provide limited purchase inquiry from customers.
5. Expeditious modification/updating of documents.
6. Ensure adequate training and user-friendliness.
7. Provide secure accessibility to all data bases.
8. Ensure data base includes comprehensive price history and vendor management information.
9. Provide adequate resources to ensure that each buyer has use of a dedicated terminal.


1
DEFINE OBJECTIVE
2
FORMULATE ASSUMPTIONS
3
CHOOSE POSSIBLE ALTERNATIVES
4
a.
DETERMINE COSTS
b.
DETERMINE BENEFITS
INTERFACE COSTS & BENEFITS FOR EACH ALTERNATIVE
5
COMPARE ALTERNATIVES
6
PERFORM SENSITIVITY ANALYSIS

Source: [Ref. 32: p. 2-2]

Figure 4.1 Cost-Benefit Analysis Process

2. Assumptions

a. Basic Assumptions

The assumptions described below establish the basis for evaluating the alternatives of this analysis.

1. Economic life of each system is eight years.
2. Current plans for implementation of APADE at the thirty-five large contracting activities will be completed within the existing schedule.
3. Costs of hardware, software, telecommunications, personnel and operations of program expansion are linear extensions of the current or expected program costs.
4. Costs already incurred or planned by the APADE, SPLICE, and APTS programs are sunk costs.
5. No inflation is assumed.
6. For all NFCS activities, costs related to procurement activity are related linearly with procurement transaction volume.
7. PALT, backlogs, and staffing are linear functions of procurement transactions volume and are accurately represented by those values obtained through interviews.
8. All ADPE assets released from service as a consequence of alternative program implementation will be reutilized to fulfill other Navy needs at no additonal cost.
9. Expected procurement volume growth rate of activity is +8.33% for dollar value.
10. Adequate space is currently available where necessary to accomodate proposed hardware expansion.

b. Specific Major Assumptions

The fundamental assumption of this analysis is that procurement volume will continue to increase throughout the NFCS at the same linear rate. The rate used has been determined by a least-squares regression analysis of total non-APADE NFCS dollar volume over the four year period 1982 through 1985. This is most pertinent to this analysis, as the procurement price savings generated through automation is the strongest contributing quantifiable benefit of these alternatives. The results of regression are shown in Table VI. While the equation generated is suspect due to the elimination of 1983 volume data because of its severe outlier character, the resulting 8.33% average annual growth between 1985 and 1994 is a sound conservative estimate of dollar volume growth for these activities. This figure is less than the forecasted growth of 9% for the large contracting activities [Ref. 6: p. A-14], but is quite appropriate in the current environment of increasing budgetary austerity and the high correlation generated by statistical analysis.

TABLE VI

Regression Analysis of Procurement Volume
Non-APADE Activities

Year	Year Variable	Dollar Volume* ($000s)
1982	1	$ 910,292
1983 (not used)	2	2,303,424
1984	3	1,286,910
1985	4	1,362,976

Regression Equation:
Dollar Volume = $770,087 + $156,240 (Year Variable)

Analysis of Variance:

SOURCE	DF	SS	MS
Regression	1	113917034496	113917034496
Error	1	3599568640	3599568640
Total	2	117516599296	

s = 59,996 R-squared = 96.9%

*Source: [Ref. 8]

Using a procurement dollar growth rate of 8.33% for the small activities, the volume is assumed to be as listed in Table VII during the economic life of the program. All price savings due to increased productivity and competition through automation, will be derived from these figures.

A second critical assumption is the projection of the staff level at work within the small contracting activities. Hardware and personnel costs are generated from these

TABLE VII

Projected Procurement Dollar Volume
Non-APADE Activities ($000s)

Year	NFCS-Wide	Sites with above $1,000 Authority
1985(actual)*	$1,362,976	$ 846,071
1986	1,476,512	916,549
1987	1,599,505	992,897
1988	1,732,744	1,075,606
1989	1,877,082	1,165,203
1990	2,033,443	1,262,265
1991	2,202,824	1,367,411
1992	2,386,324	1,481,317
1993	2,585,105	1,604,710
1994	2,801,207	1,738,383

*Source: [Ref. 8]

values. The staff levels were derived using linear regression analysis of the staff size, number of actions processed in fiscal year 1985, and the associated dollar value for 18 of the large NFCS activities whose procurement actions parallel those of the small activities. A summary of the regression analysis is provided in Table VIII. Based on this analysis, the staff levels for both the total small NFCS activities, and that portion working for small activities with purchase authority greater than $1,000 was established. Total staffing of the small NFCS activities is assumed to be 2,678 and that portion attributable to activities with authority in excess of $1,000 is 2,037.

The final critical assumption of this analysis involves distances between activities and the associated telecommunications rates involved in linking them. As all of these alternatives involve automated networking from remote activities to regionally located hardware sites, the costs of such communications represent the most significant recurring costs of each alternative. For the purposes of this

TABLE VIII

STAFFING LEVEL REGRESSION ANALYSIS

Activity	Staff Level*	# Actions*	$ Value($000s)*
NSC Pearl Harbor	48	35,396	$ 46,522
NSC Norfolk	164	71,912	192,005
NSC Oakland	138	53,447	164,123
NSC Jacksonville	52	23,975	44,804
NSC Puget Sound	102	52,941	148,010
NSC Charleston	141	68,406	187,654
NSC San Diego	79	42,375	132,055
NSD Guam	21	11,466	18,696
NSD Subic Bay	30	15,093	30,065
NSD Yokosuka	54	29,152	45,551
NAC Indianapolis	75	29,110	330,490
MCAS Cherry Point	36	23,339	26,090
NAS Pax River	48	24,990	205,069
NAS Pensacola	30	16,690	35,438
NAS Point Mugu	45	19,599	69,097
NWSC Crane	54	24,037	70,297
NOS Indian Head	31	6,204	37,225
NOS Louisville	31	12,480	52,509

Regression Equation:

$$\text{Staff Level} = -2.58 + 0.00196\,(\text{Actions}) + 0.000069\,(\$)$$

Analysis of Variance:

SOURCE	DF	SS	MS
Regression	2	29334	14667
Error	15	2161	144
Total	17	31494	

s = 12.00   R-squared = 93.1%

*Source: [Ref. 6: Appendix A]

research report, the following assumptions concerning telecommunications apply:

1. All activities with purchase authority over $1,000 will utilize at least one dedicated telephone line per activity.
2. Lease rates applicable to dedicated lines will be $72/month for local lines (1-5 miles), $129/month for lines with a distance of 6 to 25 miles, $248/month for lines with a distance of 26 to 100 miles, $435/month for lines with a distance of 101 to 300 miles, and $1,500/month for lines of more than 300 miles. [Ref. 6: p. A-28]
3. The percentages of activities in each rate category for dedicated lines are 20% local, 35% 6 to 25 miles, 15% 26 to 100 miles, 15% 101 to 300 miles, and 15% beyond 300 miles.
4. Activities with a purchase authority of $1,000 or less, due to very limited on-line requirements, will be linked via direct dial telephone lines for an average of 20 hours per month. The average monthly rate for this service is $480 (.40/min.).

3. Alternatives

a. Alternative A

This alternative will provide the full spectrum of small NFCS activities with the ability to link into the APADE system utilized by large activities. Under this alternative, each site will be supported with the terminals, software, printers, training, and telecommunications ability to link directly to an APADE site or indirectly through a non-APADE SPLICE activity. Through this on-line program design, every NFCS site will be provided with the full scope of APADE capabilities.

At a minimum, each site will have a personal computer style terminal acting as an input/output device and as a front end processor for the telecommunication link to APADE. A modem will provide the data transmission and receipt capability for each site at an extremely efficient 9,600 baud rate. In addition, at least one laser printer will be provided to facilitate the generation of all contractual documentation. Tying the system together at each site will be at least one Tandem 6600 Cluster Controller capable of driving multiple input/output devices through a single communications line. Larger activities having multiple buyers, will, of course, be provided with larger quantities of this site hardware to support their higher procurement volume. Modem sharing devices will be used as necessary, at activities requiring more than one Tandem 6600. This will keep the required number of communications lines to a minimum.

While it may appear that the smallest of activities would require only a terminal, a printer, and a modem, current system design does not allow for the terminal to drive the laser printer. Therefore, in order to maintain the laser generated document capability at each site, the Tandem 6600 Cluster Controller must be utilized.

b. Alternative B

The second alternative, B, is a constrained version of Alternative A. It provides for the extension of APADE capabilities to all NFCS activities with purchase authority greater than $1,000. The extension will, again, be accomplished through telecommunication links with either APADE or SPLICE activities. Hardware requirements for this alternative will be identical to Alternative A but without the quantities attributable to the activities with purchase authority of $1,000 and less. This alternative seeks to isolate those activities with a significant demonstrated need for automation.

c. Alternative C

This alternative will provide all of the small NFCS activities with the automated capabilities offered by APTS. Activities will be linked via telecommunications to central APTS locations. APTS hardware will be located at all small NFCS activities with purchase authority of $25,000 or more. Remote sites (purchase authority below $25,000) will be provided with terminals, printers, and the communications ability to link with an APTS site.

d. Alternative D

This alternative is restricted version of alternative C. It provides for the implementation of APTS at all small NFCS activities except those with purchase authority of $1,000 and below. Hardware installations and system configuration will otherwise remain unchanged.

e. Alternative E

An alternative in any situation is to do nothing. This would allow for the continuance of the present combination of manual and automated systems used throughout the NFCS with the exception of large activities. Desired objectives will not be achieved through this alternative. Small activities that recognize their need for automation will continue to pursue independent programs that fulfill limited requirements at high costs. Only if all of the alternatives for automation prove to be less than cost effective should this alternative be accepted.

B. COST-BENEFIT ANALYSIS OF ALTERNATIVE A

1. Identification of Costs

a. Nonrecurring costs

Costs of the nonrecurring category typically include research and development costs and the investment costs of providing the fixed assets required of a program. Alternative A research and development costs are considered sunk costs attributable to the initial development of APADE. Development, in the case of this research, consists of all costs allocated to the implementation of APADE at the thirty-five large contracting activities. The currently projected cost of this implementation is $133 million. While Alternative A makes use of some of the resources made available by the initial implementation of APADE, they are sunk costs and in no way attributable to this alternative. In addition, the SPLICE program costs, incurred and projected are also sunk costs of this alternative.

Investment costs are relevant to Alternative A. Significant hardware is required to accomplish the extension of APADE throughout the NFCS. The principle categories of hardware which determine investment costs include Processor Subsystems, Disk Subsystems, Communications Subsystems, and the Site Hardware Subsystem. The first three subsystems are located at original APADE or SPLICE activities and will require expansion to manage the increased capacity generated by the additional activity support. The Site Hardware Subsystem will be located at individual small NFCS activities and will provide the necessary terminals, printers, software, and telecommunications equipment. Costs for each of these subsystems will be determined separately.

The Site Hardware Subsystem will encompass the necessary hardware for the outfitting of all small NFCS activities. APADE system design calls for PC workstations equal to 84% of total staffing, and terminal workstations equal to 6% of total staffing. Low speed laser printers will be distributed one per site for activities with purchase authority of $1,000 and less, and activities with purchase authority in excess of $1,000 will receive a number equal to 23% of their share of workstations. [Ref. 6: p. A-27]

Telecommunication equipment requirements under the Site Hardware Subsystem will support a direct dial link capability for activities with purchase authority of $1,000 or less. Larger activities will be provided with a dedicated telecommunication line(s) for continuous on-line APADE capability. In support of this design, each activity with purchase authority of $1,000 or less will be provided with one telephone modem and one Tandem 6600 workstation cluster controller. The larger activities will possess one modem per dedicated line, one cluster controller for every six on-site workstations, and a modem sharing device if an activity has more than six workstations. It is estimated that 25% of these activities will require 13 to 18 workstations, 25% will require 7 to 12, and the remaining 50% will require six or less workstations. The Site Hardware Subsystem costs are presented as a portion of total investment cost in Table IX.

The Processor Subsystem costs will provide for the expansion of existing APADE and SPLICE installations to manage the increased demand on APADE from the addition of the 868 remote small contracting activity sites. In order to maintain satisfactory system response time, the processor expansion must be linear with respect to the potential number of workstations on-line simultaneously. The existing APADE installation at NSC Norfolk provides two Processor Subsystems to handle 148 workstations. To maintain existing response time, one additional Processor Subsystem will be required for every 75 workstations added. The cost of Processor Subsystem expansion is illustrated as a portion of total investment cost in Table IX.

Disk Subsystem costs will provide for the expansion of existing APADE and SPLICE disk storage to file the additional information created by increased numbers of procurement transactions. An additional Disk Subsystem will be required for every twelve workstations added to the APADE system. These costs are presented as part of Table IX.

The Communications Subsystems required as part of the APADE/SPLICE expansion to support this alternative will be one for every 15 incoming communications lines added. There will be one incoming line for each activity with purchase authority exceeding $1,000 (dedicated lines). With the smaller activities on-line only one hour per business day (20 hours/month), they will require one line for every eight activities within this category. These costs are also depicted in Table IX as part of total investment cost.

The final costs to be considered as investment related, concern formal initial training and site preparation/installation. Formal training cost is $300 per staff member, and site preparation/installation is $500 for each peripheral device (workstations, printers, cluster controllers, etc.) [Ref.6: p. A-28]. Table IX presents the segmented workup of total investment cost.

TABLE IX

SUMMARY OF INVESTMENT COST - ALTERNATIVE A

Activity Statistics and Requirements

	Purchase Authority		
Item	$1K and Less	Above $1K	Total
Statistics:			
*Number Activities	577	291	868
*Staff Levels	641	2037	2678
Required Peripherals:			
PC Workstations	577	1711	2288
Term. Workstations	0	122	122
Total Workstations	578	1833	2411
Number Printers	577	422	999
Modems	577	291	868
Modem Sharing Device	0	146	146
Tandem 6600	577	510	1087
Comm Lines In	73	291	364
Processor Subsystem	8	25	33
Disk Subsystem	49	152	201
Comm Subsystem	5	20	25
Total Peripherals	2371	3399	5770

Investment Cost Summary ($000s)

	Purchase Authority		
Subsystem/Item	$1K and Less	Above $1K	Total
Site Hardware Subsystem			
PC Workstations	$ 1,730	$ 5,130	$ 6,860
Term. Worksta.	0	260	260
Printers	12,694	9,284	21,978
Modems	2,440	1,231	3,671
Modem Sharing Dev.	0	6	6
Tandem 6600	1,039	918	1,957
Emulator Software	692	2,052	2,744
Total Site Subsystem	18,595	18,881	37,476
Processor Subsystems	1,194	3,731	4,925
Disk Subsystem	2,635	8,173	10,808
Comm Subsystem	660	2,640	3,300
Training	192	611	803
Prep/Installation	1,188	1,700	2,888
Total Invest. Cost	$24,464	$35,736	$60,200

*Source: [Ref. 6: Appendix A]

b. Recurring Costs

The costs of operating a system on a continuing basis that are incurred throughout the life cycle of that system are categorized as recurring costs. They typically include such items as personnel costs, maintenance costs, supplies costs, and telecommunication charges. The recurring costs associated with Alternative A can be segmented into costs of personnel, costs of maintenance, and the telecommunications costs unique to this alternative. For the purposes of the research report, all recurring costs, regardless of rate periodicity, are incurred and paid in the middle of the fiscal year. [Ref. 32: p. C-1]

Telecommunications costs represent the most significant recurring cost. The cumulative communication line lease and direct dial charges must be considered as they will be billed on a monthly basis. The charges involved must be discounted over the life cycle of the system to represent the present value cost, the basis on which all alternatives will be compared. Table X presents the recurring telecommunications costs of Alternative A.

The second recurring cost category is for the maintenance of the system components. All hardware will be subject to periodic preventive and corrective maintenance. Costs for this maintenance are assumed to be consistent with those projected for the current APADE implementation. Component and life cycle maintenance costs are tabulated in Table XI.

Costs associated with a required increase in personnel strength represent the final distinct recurring cost of Alternative A. Due to the increase in hardware necessary to support the APADE system expansion, more technicians are required to provide the corresponding operational support. As in the implementation of APADE at large

TABLE X

Recurring Telecommunications Costs, Alternative A ($000s)

Dedicated Line Activities:

	Distance						
	1-5	6-25	26-100	101-300	300+	Total	$ PV*
Activities	58	101	44	44	44	29	-
Cost/YR	$50	$156	$131	$230	$792	$1,359	$7,606

Direct Dial Activities:

Number Activities	X	Monthly Rate	X 12 =	Annual Cost	$ PV*
577	X	$480	X 12 =	$3,324	$18,604
Total Recurring Telecommunications Costs					$26,210

* Present Value, 8 Year Factor = 5.597

Source: [Ref. 32: p. C-1]

contracting activities, it is conservatively assumed that three computer operators and one systems programmer are required for every sixteen Processor Subsystems involved with the system [Ref. 6: p. A-28]. Alternative A calls for increasing Processor Subsystems by a total of 33. Eight of

TABLE XI

Recurring Maintenance Costs, Alternative A ($000s)

Annual Maintenance Costs

	Purchase Authority			
Component	$1K and Less	Above $1K	Total	PV*
PC Workstations	$173	$513	$686	$3,504
Term. Worksta.	0	24	24	123
Printers	173	127	300	1,532
Modems	58	29	87	444
Modem Sharing Dev.	0	0	0	0
Tandem 6600	173	153	326	1,665
Processor Subsystem	321	1,003	1,324	6,763
Disk Subsystem	510	1,581	2,091	10,681
Comm Subsystem	129	514	643	3,284
TOTALS	$1,537	$3,944	$5,481	$27,996

* Present Value, assumes no maintenance in first year, PV Factor = 5.108 over last seven years of system life.

these are attributable to activities with purchase authority of $1,000 and less, while the remaining 25 are called for in supporting the larger activities. With an estimated salary of $35,000 per additional person, the extension of APADE throughout the NFCS will call for twelve additional personnel at an annual cost of $420,000 [Ref.6: p. A-29]. Discounted over the life cycle of this alternative, the cost becomes $2,351,000. Other operational costs of Alternative A are not considered significantly different than for other alternatives.

c. Cost Summary

Implementation of Alternative A will generate the unique costs illustrated in Table XII.

TABLE XII

Cost Summary of Alternative A

Nonrecurring Costs ($000s)		Recurring Costs ($000s)	
Site Hardware	$37,476	Telecommunications	$37,464
Processor Subsys.	4,925	Maintenance	38,367
Disk Subsystem	10,808	Personnel	3,360
Comm. Subsys.	3,300		
Initial Training	803		
Site Prep/Instal.	2,888		
Total	$60,200	Total	$79,191

Total Present Value Cost: $116,757

2. Identification of Benefits

a. Quantifiable Benefits

The implementation of APADE throughout the NFCS will generate measurable benefits in competitive pricing, reduction of procurement backlogs, increased personnel productivity, and a decrease of PALT. Competitive pricing savings represents the most significant of these benefits. The ability of a buyer to draw on vendor and price history files will enhance their ability to find the best price for a procurement action whether or not it must be competitively bid. The competitive base dollar volume for non-APADE activities is expected to remain 90% of total procurement dollar value during the life cycle of APADE expansion. This value is supported by fiscal year 1985 actual figures in which the competitive base for current non-APADE activities was valued at $1,030,262,000 on total procurement of $1,129,690,000 or 91% of total procurement value. These activities successfully competed 75.5% of the competitive base. [Ref. 8: p. 15] Implementation of automation is expected to allow competition for an additional 14.5% of the competitive base, as activities predominantly concerned with small purchase will be able to successfully compete 90% of their competitive base. Price savings from this additional competition are conservatively assumed to be 16.75% of the dollar value of the additional procurement actions competed [Ref. 6: p. A-108]. The summary of savings to be generated from competition are presented in Table XIII.

TABLE XIII

Cost Savings From Additional Competition, Alternative A
($000s)

Year	Projected $ Volume	Increased Competition	Price Savings	PV Factor	PV of Savings
1987	$ 1,599,505	$ 208,735	$ 34,963	.954	$ 33,355
1988	1,732,744	226,123	37,876	.867	32,838
1989	1,877,082	244,959	41,031	.788	32,332
1990	2,033,443	265,364	44,449	.717	31,870
1991	2,202,828	287,469	48,151	.652	31,394
1992	2,386,324	311,415	52,162	.592	30,880
1993	2,585,105	337,356	56,507	.538	30,401
1994	2,801,207	365,558	61,231	.489	29,942
Total	$17,218,238	$2,246,979	$376,370	-	$253,012

As in the case of initial APADE implementation, productivity at automated sites is conservatively estimated to improve by 15%. Cost of personnel per $1,000 of procurement volume is taken to be the average attained at large activities, $12.28 [Ref. 6: p. A-21]. Therefore, the ability to absorb higher costs associated with larger volume is valued at $1.84 per $1,000 of volume increase. A linear projection was used for procurement volume increase resulting in an expected annual dollar value of $171,672,000. Annual productivity savings are therefore assumed to be $315,876. Using the appropriate eight year discount factor of 5.597, the present value savings attributable to productivity increases for the life cycle of the program is $1,767,958. [Ref. 6: pp. A.108-A.109]

Some backlog reduction will also be made possible by automation through this increased productivity. At activities with purchase authority of $1,000 and less, backlogs were negligible and represent no source of savings. However, at those activities whose purchase authority was in excess of $1,000, backlogs averaged three weeks, or 5.8% of annual dollar volume. The elimination of these backlogs requires the use of overtime payments to personnel. This increases personnel costs per $1,000 for this portion of total volume to $18.42. Productivity enhancement of 15% will provide a corresponding decrease in backlog volume each year. These savings therefore, represent $2.76 per $1,000 of backlogged procurement volume. Table XIV presents the life cycle savings through backlog reduction.

The final quantifiable benefit stems from the reduction of PALT. Here, again, those activities whose purchase authority is $1,000 or less will not improve upon their already low PALT of one to two days. Larger activities, however, were typically experiencing PALT of 10 to 24 days. APADE system design provides for achievement of at least a seven day PALT. Such capability will provide the activities whose purchase authority exceeds $1,000, with a PALT reduction of 30 to 71 percent. [Ref. 6: p. A-115]

TABLE XIV

Backlog Reduction Cost Savings, Alternative A ($000s)

Year	Projected $ Volume	Projected Backlog	Reduction Savings	PV Factor	PV of Savings
1987	$ 992,897	$ 57,588	$ 159	.954	$ 152
1988	1,075,606	62,385	172	.867	149
1989	1,165,203	67,582	187	.788	147
1990	1,262,265	73,211	202	.717	145
1991	1,367,411	79,310	219	.652	143
1992	1,481,317	85,916	237	.592	140
1993	1,604,710	93,073	257	.538	138
1994	1,738,383	100,826	278	.489	136
Tot.	$10,687,792	-	$1,711	-	$1,150

b. Nonquantifiable Benefits

There are numerous benefits to be achieved from the NFCS-wide implementation of APADE that are too difficult if not impossible to state in numeric terms. The nonquantifiable benefits obtained by the large contracting activities through the implementation of APADE will also be evident at the small activities. Error reduction will be significant, lending to an increase in the effectiveness and efficiency of the Navy's procurement function. APADE will provide for automatic validation of many data entries, decreasing the probability of errors. Automated document production will also save significant effort generally associated with final production of a smooth contract.

A significant reduction of the paperwork shuffle associated with current manual systems will provide for a more gratifying working environment for procurement personnel. This enhanced environment will reduce personnel turnover and provide a foundation for greatly improved personal productivity. This also provides a major step in the direction of the desired "paperless procurement process" sought by NAVSUP [Ref. 33].

Additional benefits available through alternative A include:

1. Consolidation of requisitions for more economical purchases.
2. Enforced compliance with existing procurement standards and directives.
3. Increased negotiation effectiveness with support of comprehensive price, vendor, and commodity data bases.
4. Elimination of duplicate and diverse attempts at automation of individual activities.
5. Standardization of Navy-wide procurement automation enhancing transportability of personnel throughout the NFCS.

Finally, the standardized use of the APADE system, NFCS-wide, will enhance the adaptation to centralized data bases, accessible by all users, to be conceived within the FENICS project in the near future.

3. Cost-Benefit Summary

The summarization of the costs and benefits associated with Alternative A, implementing APADE throughout the NFCS, is illustrated in Table XV.

TABLE XV

Summary of Costs and Benefits, Alternative A
($000s)

Costs		Benefits	
Nonrecurring	$ 60,200	Price Savings	$253,012
Recurring	56,557	Productivity	1,768
		Backlog Reduction	1,150
Total Costs	$116,757	Total Benefits	$255,930

Benefit/Cost Ratio: 2.192

C. COST-BENEFIT ANALYSIS OF ALTERNATIVE B

1. Identification of Costs

a. Nonrecurring costs

Alternative B nonrecurring costs are much the same as those involved in Alternative A. The categories remain unchanged, but due to the lesser number of activities to be involved in the network, the investment costs will be similarly reduced. Again, all research and development cost is deemed to be sunk and attributable to the implementation of APADE at the large contracting facilities. Investment costs that are attributable to Alternative B can be identified in Table IX under the subheading for activities with purchase authority above $1,000. This total nonrecurring cost is $35,736,000.

b. Recurring Costs

These costs are also similar in type to Alternative A, and include the costs of personnel, maintenance, and telecommunications. The costs considered here are assumed to be paid in the middle of the fiscal year [Ref. 32: p. C-1].

Telecommunications costs under Alternative B are concerned only with dedicated line communications to the activities whose purchase authority exceeds $1,000. As can be seen in the Dedicated Line Activities section of Table X, the total annual cost of leased lines is $1,359,000. Discounted over the life of the program, this represents a total present value cost of $7,606,000.

Maintenance costs for Alternative B can be seen in Table XI in the Above $1K column. The annual cost of maintenance for this alternative is $3,944,000. Over the eight year life cycle of the system, the present value cost of maintenance is $20,146,000. This assumes no maintenance during the first year of operation, and is discounted over the last seven years.

Costs for additional personnel for this alternative must be determined based upon the required number of Processor Subsystems called for with Alternative B, 25. With four personnel required for each sixteen Processor Subsystems, a total of eight additional personnel will be required under this alternative. With an average salary of $35,000 each, the annual cost for these personnel will be $280,000. Discounted over the life cycle of the system, this cost in terms of present value is $1,567,160. As in Alternative A, other operational costs of Alternative B are not considered to be significantly different than for any of the other alternatives.

c. Cost Summary

Implementation of Alternative B will generate the unique costs illustrated in Table XVI.

TABLE XVI

Cost Summary of Alternative B

Non-recurring Costs ($000s)		Recurring Costs ($000s)	
Site Hardware	$18,881	Telecommunications	$10,872
Processor Subsys.	3,731	Maintenance	27,608
Disk Subsystem	8,173	Personnel	2,240
Comm. Subsys.	2,640		
Initial Training	611		
Site Prep/Instal.	1,700		
Total	$35,736	Total	$40,720

Total Present Value Cost: $ 65,055

2. Identification of Benefits

a. Quantifiable Benefits

As a constrained version of Alternative A, this alternative will provide the same benefits at less value. These benefits will encompass increased price savings due to competition, reduction of procurement backlogs, increased personnel productivity, and a reduction of PALT. As in Alternative A, the competitive base for the activities whose purchase authority exceeds $1,000 will be 90% of total procurement dollar value. The capability to compete an additional 14.5% of the competitive base for a 16.75% price savings, also applies. Table XVII details the cost savings to be generated from increased competition under Alternative B.

Productivity gains through this alternative are assumed to be 15%. Again, cost of personnel per $1,000 of procurement volume is $12.28. The ability to absorb higher costs associated with larger volume is valued at $1.84 per $1,000 of volume increase. Average volume increase for the activities with greater than $1,000 purchase authority is $106,498,000 per year. The corresponding productivity

TABLE XVII

Cost Savings From Additional Competition, Alternative B ($000s)

Year	Projected $ Volume	Increased Competition	Price Savings	PV Factor	PV of Savings
1987	$ 992,897	$ 129,573	$ 21,703	.954	$ 20,705
1988	1,075,606	140,367	23,511	.867	20,384
1989	1,165,203	152,059	25,470	.788	20,070
1990	1,262,265	164,726	27,592	.717	19,783
1991	1,367,411	178,447	29,900	.652	19,488
1992	1,481,317	193,312	32,380	.592	19,169
1993	1,604,710	209,415	35,077	.538	18,871
1994	1,738,383	226,859	37,999	.489	18,581
Total	$10,687,792	$1,394,758	$233,632	-	$157,051

savings are valued at $195,956. Using the eight year discount factor of 5.597, the present value savings are $1,096,768.

Reduction of backlog associated with Alternative B is precisely the same as found in Alternative A, because all backlogs were attributable to these larger activities. The present value of backlog reductions was determined in Table XIV and is valued at $1,150,000.

The reduction of PALT, as mentioned in Alternative A, is attributable to the activities with purchase authority greater than $1,000 only. These activities, the basis of Alternative B, will experience PALT reduction to seven days, representing a 30 to 71 percent PALT decrease.

b. Nonquantifiable Benefits

The nonquantifiable benefits generated under Alternative A will also be recognized for Alternative B. They will not, however, be provided to the 577 smallest NFCS activities eliminated under this alternative. These NFCS activities would see some benefit in the response time applicable to requisitions that they must refer to the larger NFCS facilities covered under this alternative.

3. Cost-Benefit Summary

Alternative B costs and benefits are summarized and presented in Table XVIII.

TABLE XVIII

Summary of Costs and Benefits, Alternative B ($000s)

Costs		Benefits	
Nonrecurring	$35,736	Price Savings	$157,051
Recurring	29,319	Productivity	1,097
		Backlog Reduction	1,150
Total Costs	$65,055	Total Benefits	$159,298

Benefit/Cost Ratio: 2.449

D. SENSITIVITY ANALYSIS

At this point, both programs yield benefit-cost ratios in excess of one. This indicates that either one will prove to be cost effective, producing a net benefit if either is implemented.

Several assumptions had to be made during the course of this analysis that have severe impact on outcomes of the analysis. The two most significant assumptions were those associated with telecommunications rates, and the additional competition level achieved through automation that yields substantial price savings. These two contributors to cost and benefit, respectively, are those most subject to fluctuation and will therefore be the focus of the sensitivity analysis.

Specifically, this analysis will investigate the impact on both the total present value net benefit(cost), and the benefit-cost ratio, of the following circumstances:

1. Communications rates increase ten percent.
2. Communications rates increase twenty percent.
3. Automation allows activities to successfully compete an additional ten percent of the competitive base over the existing manual level.
4. Automation allows activities to successfully compete an additional five percent of the competitive base over the existing manual level.

Table XIX presents the results of each of these circumstances under both Alternative A and Alternative B, using the above subparagraph numbers to identify the event.

As can be seen in Table XIX, the preeminent variable with the greatest impact on the cost effectiveness of either alternative is competitive price savings. As long as there is a seven percent increase in successfully competing the competitive base, other variables remaining constant, both Alternatives A and B provide a positive net benefits.

TABLE XIX

Sensitivity Analysis, Alternatives A and B
($000s)

Alternative/ Event	Present Value of Net Benefit(Cost)	Benefit-Cost Ratio
A/Original Result	$139,173	2.192
A/1	136,552	2.144
A/2	133,931	2.098
A/3	60,652	1.519
A/4	(26,593)	0.772
B/Original Result	94,243	2.449
B/1	93,482	2.420
B/2	92,722	2.393
B/3	45,505	1.699
B/4	(8,652)	0.867

V. COST-BENEFITS OF ADAPTING THE AUTOMATED PROCUREMENT TRACKING SYSTEM

A. NON-APADE ALTERNATIVES

The following two alternatives, C and D, involve the adaptation of the Automated Procurement Tracking System to the small activities of the NFCS. These alternatives will require the use of Wang VS hardware at the largest 291 of the non-APADE activities, with accessibility provided to the remaining 577 NFCS activities through remote networking. Each of the smaller activities will be provided with Wang PC Remote terminals, daisy wheel printers, applicable software, and the necessary telecommunications hardware to allow for networking.

Alternative C will provide access to APTS/APPMS for all of the activities within the NFCS not using APADE. Activities with purchase authority in excess of $1,000 will be designated as the sites for mainframe installation of the Wang VS 65 and necessary disk storage to support the NFCS. There are 291 of these activities. All remaining activities will be linked to these sites via telecommunications lines, and be able to run the APTS/APPMS application on their Wang PC Remote terminals. There will be 577 remote locations under this alternative. The 577 smaller remote activities will function with direct dial capability. The limited use of the system expected of these smaller activities does not warrant the use of a single dedicated line. They will be expected to use only 20 hours per month of actual on-line time.

Alternative D will be a constrained version of Alternative C. Here, the fundamental system design remains the same, but the number of remote locations and associated peripherals will be reduced to only those required in support of activities whose purchase authority is above $1,000. This will eliminate the 577 remote activities who use direct dial interfacing under Alternative C.

A listing of prices used in the determination of system costs is provided for both the APTS/APPMS alternatives and the APADE alternatives in Appendix E.

B. COST-BENEFIT ANALYSIS OF ALTERNATIVE C

1. Identification of Costs

a. Nonrecurring Costs

The costs of hardware/software investment, initial pesonnel training, and of site preparation and installation will be considered nonrecurring costs. All research and development costs are borne by the commercial vendor and are absorbed in the procurement of the application packages.

Investment costs consist of the purchase of the hardware and software required to make the system initially operational. These costs for Alternative C are presented in Table XX. For the purposes of this research report, the nonrecurring costs are segmented into subsystems required in support of APTS/APPMS, and include the Site Subsystem, the CPU Subsystem, Training, and Site Preparation and Installation. The Site Subsystem requirements provide the hardware and software necessary to access APTS/APPMS and print its output. Specifically, this subsystem consists of the Wang PC Remote computer terminal and the associated software needed to allow it to interface with VS machines. These terminals will be used by the remote sites, those activities with purchase authority of $1,000 or less. Buyers located at activities with mainframes will be furnished with the Wang 4230A Terminal. Both terminal types have the ability to interface with the mainframe and download files for printing and word processing. The PC Remote terminal is used due to the 4230A's lack of remote use capability. Printers furnished with each terminal are letter quality daisy wheel type, capable of printing on preprinted forms through word processing applications. Modems are required at all activities to provide the networking capability needed by the sites without CPU's. The remote sites will have an assigned host with which to link. These assignments will ensure that the workload of a remote activity will be centralized at one location, while the total workload of all of these sites is evenly distributed over the VS machine assets. Terminals are assigned based upon a 90% of total staff figure. There will be one printer per terminal, and all remote sites must possess one modem with which to communicate with the host activity.

The CPU subsystem provides the hardware required to provide the APTS/APPMS application NFCS-wide. Each NFCS activity with a purchase authority in excess of $1,000 will receive one Wang VS 65 minicomputer as the system mainframe. This is the smallest machine available capable of handling the number of terminal workstations (2,411) in this system. It also provides room for ample growth in support should it be necessary. Disk storage is provided to support all of the activities included within this system alternative. Total disk space requirements are forty megabytes per terminal [Ref. 34]. This alternative has a total storage requirement of 96,440 megabytes. The requirement will be satisfied by the addition of a Disk Storage Cabinet for each VS machine that has a storage capacity of 223 megabytes. The additional need, not filled by the basic cabinets, will be satisfied by the addition of 176 megabyte removable modules to the basic cabinets. The cost of these modules is allocated to the activities causing their requirement in Table XX. Included

TABLE XX

Summary of Investment Costs, Alternative C

Activity Statistics and Requirements

Item	Purchase Authority $1K and Less	Above $1K	Total
Statistics:			
Number Activities	577	291	868
Staff Level	641	2,037	2,678
Required Peripherals:			
PC Remote Stations	577	0	577
4230A Terminals	0	1,834	1,834
Printers	577	1,834	2,411
Modems	577	577	1,154
Wang VS 65	0	291	291
Disk Storage Units	0	291	291
Add-on Disk Storage	132	49	181
Total Peripherals	1,863	4,876	6,739
APTS/APPMS Package	0	291	291

Investment Cost Summary
(000s)

Subsystem/Item	Purchase Authority $1K and Less	Above $1K	Total
Site Subsystem			
PC Remote	$2,213	$ 0	$ 2,213
4230A Terminal	0	3,430	3,430
Printers	1,154	3,668	4,822
Modems	289	289	578
Total Site Subsys.	3,656	7,387	11,043
CPU Subsystem			
Wang VS 65	0	4,935	4,935
Disk Storage Cab.	0	5,565	5,565
Add-on Disk	1,122	417	1,539
APTS/APPMS	0	29,100	29,100
Total CPU Subsys.	1,122	40,017	41,139
Training	321	1,019	1,340
Site Prep/Instal.	932	2,438	3,370
Total Invest. Cost	$6,031	$50,861	$56,892

in this subsystem is the cost of the APTS/APPMS application software available from Omega Computer Systems, Incorporated. [Ref. 35]

Training costs are assumed to be $500 per staff member of activities involved with the system. This represents a larger cost than the $300 involved with the APADE alternatives because no dedicated training program yet exists for this commercially generated system. A conservative estimate of $200 per staff member is allocated for training program development and staffing.

Site preparation and installation of hardware is assumed to be $500 per peripheral device. These costs are highly labor intensive and should be similar to those incurred for the installation of any similar automated system. Hence, the forecast per device used for APADE is also applicable to Alternatives C and D.

b. Recurring Costs

The recurring costs under Alternative C include telecommunications costs for remote sites, and periodic preventive and corrective maintenance costs. For the purposes of this research report, all recurring costs, regardless of rate periodicity, are incurred and paid in the middle of the fiscal year.

Telecommunications costs represent the cost of providing direct dial networking capability to remote sites. Due to the wider distribution of Wang VS 65 machines called for in this alternative, as opposed to CPU distribution in the APADE alternatives, the average monthly rate per remote activity will be 75% of what it was for APADE as a conservative estimate. The rate then becomes $360/month per remote activity. Based on the discount factor associated with an eight year life cycle, 5.597, the total present value cost of telecommunications is $13,951,306.

The only other significantly unique recurring cost attributable to Alternative C is concerned with the maintenance necessary to keep the APTS/APPMS system operational. The cost of this maintenance is conservatively estimated, by a Wang representative, to be 10% of the component cost per year [Ref. 35]. No maintenance will be performed during the first year of operation and will commence with full rates applied during the second year of the system life cycle. The total maintenance costs applicable to Alternative C are presented in Table XXI.

TABLE XXI

Recurring Maintenance Costs, Alternative C
(000s)

Annual Maintenance Costs

Component	Purchase Authority $1K and Less	 Above $1K	Total	PV*
PC Remotes	$221	$ 0	$ 221	$ 1,129
4230A Terminals	0	343	343	1,752
Printers	115	367	482	2,462
Modems	29	29	58	296
Wang VS 65	0	494	494	2,523
Disk Stor. Cab.	0	557	557	2,845
Add-on Disk Stor.	112	42	154	787
TOTALS	$477	$1,832	$2,309	$11,794

c. Cost Summary

Implementation of Alternative C will generate the unique costs illustrated in Table XXII.

TABLE XXII

Cost Summary of Alternative C

Nonrecurring Costs (000s)		Recurring Costs (000s)	
Site Subsystem	$ 11,043	Telecommunications	$ 19,941
CPU Subsystem	41,139	Maintenance	16,163
Training	1,340		
Site Prep/Instal.	3,370		
Total	$ 56,892	Total	$ 36,104

Total Present Value Cost: $ 82,637

2. Identification of Benefits

a. Quantifiable Benefits

The implementation of APTS/APPMS throughout the NFCS will provide similar benefits to those furnished by the proposed implementation of APADE. Savings from reduction of backlogs, improved productivity, and price savings resulting from increased competition of the competitive base can each be recognized in monetary terms. Additionally, a reduction of PALT can be effected.

As in the case of APADE alternatives, the most significant quantifiable benefit resulting from the NFCS-wide implementation of APTS/APPMS is the cost savings that result from the ability to successfully compete a larger portion of the competitive base than is possible under the current manual system. Due to the lack of a comprehensive procurement price history file in APTS/APPMS, its implementation will result in the additional competition of 5% of the competitive base. This improvement stems from the availability of a thorough vendor listing and the general productivity increase associated with automation. Price savings from increased competition are conservatively estimated at 16.75% [Ref. 6: p. A-108]. The assumption that the competitive base is 90% of total procurement dollar volume applies. Table XXIII presents a breakdown of the price savings to be achieved through the implementation of Alternative C.

TABLE XXIII

Cost Savings From Additional Competition, Alternative C
($000s)

Year	Projected $ Volume	Increased Competition	Price Savings	PV Factor	PV of Savings
1987	$ 1,599,505	$ 71,978	$12,056	.954	$11,502
1988	1,732,744	77,973	13,061	.867	11,324
1989	1,877,082	84,469	14,149	.788	11,149
1990	2,033,443	91,505	15,327	.717	10,989
1991	2,202,828	99,127	16,604	.652	10,826
1992	2,386,324	107,385	17,987	.592	10,648
1993	2,585,105	116,330	19,485	.538	10,483
1994	2,801,207	126,054	21,114	.489	10,325
Total	$17,218,238	$774,821	$129,783	-	$ 87,246

Productivity through the implementation of automation in Alternative C, will improve by 15%. The increase in productivity will be realized through the absorption of increasing procurement volume by existing personnel assets. The current personnel related costs per $1,000 procurement volume is $12.28. The 15% productivity increase will allow current personnel to absorb $1.84 of that cost, resulting in a realizable savings of that amount. As depicted in Chapter IV, projected procurement volume growth for the small activities of the NFCS will average $171,672,000 per year. The productivity cost savings on that growth amounts to $315,876 annually. Discounted over the eight year life cycle of this alternative, productivity enhancement provides for a present value savings of $1,767,958. [Ref. 6: pp. A.108-A.109]

An additional result of increased productivity is a general reduction of procurement backlogs. Backlogs are currently significant only at those activities with purchase authority in excess of $1,000. Reduction of these backlogs will result in financial savings from the corresponding decrease in overtime payments needed to liquidate such backlogs. The savings figures for Alternative C will be the same as those achieved under Alternative A in Chapter IV. These are fully illustrated in Table XIV and described on pages 76 and 77. The present value savings generated by the reduction of backlogs is $1,150,000.

The final quantitative benefit derived from the implementation of Alternative C, is a reduction of PALT. Currently satisfactory at activities with purchase authority of $1,000 and less, the benefit here will be obtained by the larger NFCS activities. These activities are currently experiencing a PALT ranging from 10 to 24 days. There is no stated PALT objective provided in APTS/APPMS documentation, but a conservative expectation of PALT resulting from a system with Alternative C's features, is ten days [Ref. 34].

Achieving this PALT will provide for PALT reductions ranging up to 42 percent.

b. Nonquantifiable Benefits

The most significant benefit received from the implementation of Alternative C, in nonquantitative terms, will be the reduction of errors. With the APPMS upgrade, this system becomes extremely user friendly and easy to work with. Automatic data entry validation and a comprehensive on-line data element dictionary make errors in data input nearly impossible. A thorough clause matrix file allows for the expeditious identification and correct use of appropriate contract clauses.

Implementation of an automated procurement system, particularly an efficient one as in Alternative C, helps to provide a more pleasant working environment through the reduction of paperwork and the physical manipulation of files and reports. A healthier working environment will help in improving retention of quality personnel, adding to the improvement of overall effectiveness.

Unique to this alternative, is the significant reduction in the number of telecommunications lines necessary to support remote activities. This feature, too, will have a positive impact on personnel by allowing unhindered access to the host activity at any time. Terminal support for each VS machine will be small enough to ensure continued efficient response time. Also, the location of printers with the terminals allows buyers to immediately see and evaluate the results of their actions.

While this system is quite different and currently incompatible with APADE at the large NFCS activities, it does provide for the standardization of procurement systems used by the remainder of the NFCS. It is not incomprehensible to envision an ultimate modification of APTS/APPMS that will allow for an interface with APADE data bases. The largest drawback of this alternative is its lack of a price history data base. It must be noted, when speaking of future modifications, that Omega Computer Systems is developing such a data base capability for future implementation [Ref. 36].

3. Cost-Benefit Summary

The summarization of the costs and benefits associated with Alternative C, implementing APTS/APPMS throughout the NFCS, is illustrated in Table XXIV.

TABLE XXIV

Summary of Costs and Benefits, Alternative C
($000s)

Costs		Benefits	
Nonrecurring	$56,892	Price Savings	$87,246
Recurring	25,745	Productivity	1,768
		Backlog Reduction	1,150
Total Costs	$82,637	Total Benefits	$90,164

Benefit/Cost Ratio: 1.091

C. COST-BENEFIT ANALYSIS OF ALTERNATIVE D

1. Identification of Costs

a. Nonrecurring Costs

Alternative D is a constrained version of Alternative C in that it eliminates the remote sites from the system. The eliminated activities represent those with a purchase authority of $1,000 and less. Here, too, all research and development costs are incurred by the commercial vendor providing the system, and are absorbed in the prices of hardware and software investments. Investment costs associated with Alternative D are presented in Table XX under the heading Above $1K. This figure must be reduced by the cost of modems allowed in Alternative C but no longer necessary under this alternative. The investment cost for Alternative D is, therefore, $50,572,000.

b. Recurring Costs

These costs are similar to those experienced under Alternative C, except that telecommunications costs are totally eliminated. Maintenance costs are reduced to those depicted in Table XXI under the heading Above $1K. As with investment costs, this figure must be reduced by the cost of maintenance of modems because they are no longer used in the system. The annual maintenance cost becomes $1,803,000 under Alternative D. The present value total cost of this maintenance is $9,210,000. There will be no maintenance during the first year of the program.

There are no additional personnel required by the system proposed in this alternative, and all other operational costs are not considered to be significantly different than those of any other alternative.

c. Cost Summary

The implementation of Alternative D will require the absorption of the unique costs summarized in Table XXV.

TABLE XXV

Cost Summary of Alternative D

Nonrecurring Costs ($000s)		Recurring Costs ($000s)	
Site Subsystem	$ 7,098	Maintenance	$12,621
CPU Subsystem	40,017		
Training	1,019		
Site Prep/Instal.	2,438		
Total	$50,572	Total	$12,621

Total Present Value Cost: $ 59,782

2. Identification of Benefits

a. Quantifiable Benefits.

As a constrained version of Alternative C, this alternative will provide virtually the same benefits, at less value. Most significant is the benefit to be derived form the increased capability to successfully compete the competitive base. As in Alternative C, the implemtation of an automated system, coupled with a comprehensive bidder listing will allow for the successful competing of an additional 5% of the competitive base attributable to these activities. Table XXVI presents the savings generated by increased competition resulting from implementation of Alternative D.

TABLE XXVI

Cost Savings From Additional Competition, Alternative D
($000s)

Year	Projected $ Volume	Increased Competition	Price Savings	PV Factor	PV of Savings
1987	$ 992,897	$ 44,680	$ 7,484	.954	$ 7,140
1988	1,075,606	48,402	8,107	.867	7,029
1989	1,165,203	52,434	8,783	.788	6,921
1990	1,262,265	56,802	9,514	.717	6,822
1991	1,367,411	61,533	10,307	.652	6,720
1992	1,481,317	66,659	11,165	.592	6,610
1993	1,604,710	72,212	12,096	.538	6,507
1994	1,738,383	78,227	13,103	.489	6,407
Total	$10,687,792	$480,949	$80,559	-	$54,156

These savings due to increased competition are derived from the competitive base, determined to be 90% of the total procurement dollar volume for activities with a purchase authority in excess of $1,000. The realizable cost savings are conservatively estimated to be 16.75% of the additional 5% of the competitive base being competed.

Gains in productivity produced through the implemetation of Alternative D will average 15% amongst these activities. The current personnel costs per $1,000 of total procurement dollar volume remains $12.28. Therefore, the cost savings to be realized under this alternative through the absorption of workload by existing personnel is valued at $1.84 per $1,000 of yearly volume increase. The average volume increase for activities with purchase authorities greater than $1,000 during the life cycle of this alternative is $106,498,000 annually. The corresponding productivity savings each year are valued at $195,956. In terms of present value life cycle benefit, this represents a savings of $1,096,768.

The benefit achieved through the reduction of backlogs for Alternative D, is exactly the same as that realized in Alternative C. This occurs due to the backlogs being solely attributable to activities with purchase authority in excess of $1,000. The present value of the backlog reduction identified in Table XIV applies equally to this alternative and is valued at $1,150,000.

As in Alternative C, PALT will improve for these activities from its current range of 10 to 24 days, to a maximum of ten days. This represents a PALT improvement of up to 42%.

b. Nonquantifiable Benefits

The nonquantifiable benefits generated under Alternative C will also be realizable for this alternative. Like the relationship between Alternatives A and B in Chapter IV, the benefits of the larger scope alternatives (A and C) will not be provided to the smallest 577 NFCS activities eliminated under the smaller scope alternatives (B and D).

3. Cost-Benefit Summary

The costs and benefits associated with Alternative D are summarized in Table XXVII.

TABLE XXVII

Summary of Costs and Benefits, Alternative D
($000s)

Costs		Benefits	
Nonrecurring	$ 50,572	Price Savings	$ 54,156
Recurring	9,210	Productivity	1,097
		Backlog Reduction	1,150
Total Costs	$ 59,782	Total Benefits	$ 56,403

Benefit/Cost Ratio: 0.944

D. SENSITIVITY ANALYSIS

Given the data and assumptions of Alternatives C and D, both appear to be marginally cost-effective proposals. Each has a Benefit/Cost ratio of close to one, indicating that a breakeven position would result from their implementation.

The assumptions are sound, with only one variable even remotely capable of changing significantly enough to make either of the alternatives substantially cost-effective. This variable is the cost savings generated from increased competition. The assumption was that an additional 5% of the competitive base could be successfully competed through the implementation of APTS/APPMS in either alternative.

This sensitivity analysis will determine that increased percentage of the competitive base that must be successfully competed as a result of these automation alternatives, in order to make either or both alternatives, cost-effective with benefit to cost ratios of 1.5. Table XXVIII presents this sensitivity analysis.

TABLE XXVIII

Sensitivity Analysis for Alternatives C and D

Item	Alt. C	Alt. D
Total Present Value Cost	$82,637	$59,782
Total Present Value Benefit Needed for 1.5 B/C ratio	$123,956	$89,673
Total Present Value Benefit	$90,164	$56,403
Current Shortfall of 1.5 ratio	$33,792	$33,270
Required Additional Savings	$33,792	$33,270
Current Competition Savings	$87,246	$54,156
Percentage Increase Required	38.73	61.43
Current increased percentage of competitive base successfully competed due to alternative	5.00	5.00
Increased percentage of the competitive base required to be competed to achieve the cost-benefit breakeven point	6.94	8.07

This sensitivity analysis indicates that the NFCS activities receiving APTS/APPMS under Alternatives C or D will have to increase the percentage of the competitive base that they are successfully competing by 6.94% or 8.07%, respectively, in order for the total present value benefits to exceed the total present value costs by 50%. This assumes that all other variables remain unchanged. Further, these increases must result solely from the implementation of automation provided by the alternative concerned.

VI SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

This thesis has attempted to answer the following question. Given the existing requirement for automation, should small contracting activities link to the existing APADE system or develop their own local automated contracting system? In evaluating this problem, the following additional questions were considered.

1. What is the impetus behind current automation requirements?
2. What are the automation needs of the small contracting facility?
3. Can APADE efficiently fulfill the needs of the small contracting office?
4. Are existing locally developed systems, when implemented, fulfilling the automation needs of the small field contracting activity?
5. Could an existing local system be efficiently linked to APADE to provide common database information for continuity within the procurement system?
6. What are the associated cost-benefits of linking to APADE and those of implementing a local system?
7. Given the cost-benefits of the alternatives, which alternative provides the best support for the small contracting activity within the present environment of budget austerity?

In order to answer these questions, the research effort relied upon a thorough literature search of pertinent information, on-site visits and intensive interviews of personnel involved with automated procurement systems, and an informal survey of a sample of non-APADE designated contracting activities to determine their perceived need for automation. Finally, a cost-benefit analysis was conducted on four alternatives for small activity automation involving the use of the two most comprehensive automated systems currently available.

The automation of the procurement process in the U. S. Navy is evolving from initiatives developed during early 1980's by both the legislative and executive branches of the federal government. In order to cope with a growing number of well publicized purchasing problems and the anticipation of escalating procurement volume, requirements for standardized and more efficient federal procurement processes have been imposed upon all federal agencies. In response, NAVSUP has turned to automation as a means to establish both standardization and increased efficiency of the Navy's procurement process. The thirty-five largest activities within the Navy Field Contracting System are scheduled to receive the Automation of Procurement and Accounting Data Entry (APADE) system as an automated solution to the procurement problem. While these activities account for a substantial portion of the Navy's procurement volume, there remain a significant number of NFCS activities not covered by this project whose procurement action is no less substantial. In their efforts to effectively deal with this significant workload, many of these small NFCS activities have taken steps to automate their processes on a local level with limited success. Others continue to be burdened by the gross inefficiencies of a tedious manual processing system. With a continued concern for standardization and increased procurement efficiency, NAVSUP is currently seeking a cost-effective means to extend automation to the small NFCS activities.

In order to effectively identify systems for potential use at the small NFCS activity level, an awareness of their automation needs is of paramount importance. A structured survey, performed by the authors, of contracting personnel operating within the small NFCS activities indicated a varying need for automation that was strongly influenced by the activity's level of purchase authority. Based upon the results of the survey and available procurement action data, those activities with a purchase authority exceeding $1,000 demonstrate a real and immediate need for automation substantiated by high PALT values and increasing processing backlogs. While the efficiency of those activities whose purchase authority is $1,000 or less can certainly benefit from automation, their actual need is less immediate. The requirements for automation identified by the small NFCS activities include:

1. Automatic preparation of procurement documentation.
2. Real-time tracking of purchase requests.
3. Ability to rapidly modify and/or update procurement processing actions or documents as needed.
4. Comprehensive data bases for vendor information and price history.
5. Adequate terminal access for all buyers, supervisors, and and other procurement personnel as necessary.
6. Automatic calculation and generation of all required procurement reports.
7. Adequate training and user-friendliness to expedite productive implementation.

These requirements are similar to those associated with the large NFCS activity's small purchase responsibilities. Implementation of APADE adequately provides for each of the above listed requirements while offering additional features in support of large purchase actions. While APADE would provide for fully adequate support of the small NFCS activity, it is an expensive system and cannot be assumed to be the most cost-effective means to provide small activity automation.

Numerous locally developed automated procurement systems are available within the NFCS for exportation to other small activities. Systems considered as potential alternatives to APADE include the Automated Acquisition Module (AAM) and the Automated Procurement Tracking System/Automated Procurement Production and Management System (APTS/APPMS). Both of these systems have been successfully utilized by a limited number of NFCS activities, but APTS/APPMS provides a more generalized application easily adaptable to the procurement processing at other small NFCS activities. An analysis of system features resulted in the selection of APADE and APTS/APPMS as the two most viable alternatives for automating the small NFCS activity.

The two alternatives were subjected to cost-benefit analysis to determine which, if either, could be implemented in the most cost-effective manner. Due to the distinct difference in the automation needs between those activities with purchase authority above $1,000 and those with authority of $1,000 and below, as discovered through this research effort, each of the considered systems was further segmented by alternatives concerning scope of implementation. The resulting four alternatives analyzed were:

1. Implementation of APADE NFCS-wide.
2. Implementation of APADE at all NFCS activities with purchase authority exceeding $1,000.
3. Implementation of APTS/APPMS at all non-APADE NFCS activities.
4. Implementation of APTS/APPMS at all NFCS activities with purchase authority exceeding $1,000.

As always, an inherent alternative is to do nothing, maintaining the status quo. The selection of this alternative would only be made in the event that all of the system alternatives proved not to be cost-effective. Maintaining the current level of nonstandard automated and manual procurement processing systems can in no way achieve the overall objectives of standardization and increased efficiency.

B. CONCLUSIONS

The comparison of alternatives yields four different sets of costs and benefits. A quantifiable comparison must therefore be based upon resulting benefit to cost ratios of each of the alternatives [Ref. 32: p. 2-6]. The associated cost-benefit summaries of each alternative are restated in Table XXIX.

The quantifiable comparison of the alternatives results in the following ranking from high to low benefit to cost ratios:

1. Alternative B : Benefit/Cost Ratio = 2.449
2. Alternative A : Benefit/Cost Ratio = 2.192
3. Alternative C : Benefit/Cost Ratio = 1.091
4. Alternative D : Benefit/Cost Ratio = 0.944

Alternatives C or D should not be considered further, as neither yields a significant net benefit from implementation. The features of these alternatives are not as comprehensive as those associated with APADE, thereby negating all potential consideration to accept any marginal costs or benefits to obtain unique advantages that may be offered by Alternatives C or D. Finally, the sharing of data bases NFCS-wide, as envisioned by NAVSUP with the development of the FENICS system, could not be achieved while using the systems proposed in Alternatives C and D without significant software redesign at substantial additional cost.

The APADE alternatives, however, both yield net benefits from implementation. Alternative B, implementation of APADE at all NFCS activities with purchase authority in excess of $1,000, provides for the greatest return on investment. It also represents the least total cost alternative of those associated with APADE having a total present value cost of $65,055,000 as compared to the $116,757,000 total present value cost of Alternative A. The implementation of Alternative B provides automation to those small NFCS activities that have a demonstrated immediate need for such automation.

TABLE XXIX

COST-BENEFIT SUMMARY OF ALTERNATIVES

Alternative A

Costs		Benefits	
Nonrecurring	$ 60,200,000	Price Savings	$253,012,000
Recurring	56,557,000	Productivity	1,768,000
		Backlog Reduction	1,150,000
Total Costs	$116,757,000	Total Benefits	$255,930,000
Net Benefit	$139,173,000	Benefit/Cost Ratio:	2.192

Alternative B

Costs		Benefits	
Nonrecurring	$ 35,736,000	Price Savings	$157,051,000
Recurring	29,319,000	Productivity	1,097,000
		Backlog Reduction	1,150,000
Total Costs	$ 65,055,000	Total Benefits	$159,298,000
Net Benefit	$ 94,243,000	Benefit/Cost Ratio:	2.449

Alternative C

Costs		Benefits	
Nonrecurring	$ 56,892,000	Price Savings	$ 87,246,000
Recurring	25,745,000	Productivity	1,768,000
		Backlog Reduction	1,150,000
Total Costs	$ 82,637,000	Total Benefits	$ 90,164,000
Net Benefit	$ 7,527,000	Benefit/Cost Ratio:	1.091

Alternative D

Costs		Benefits	
Nonrecurring	$ 50,572,000	Price Savings	$ 54,156,000
Recurring	9,210,000	Productivity	1,097,000
		Backlog Reduction	1,150,000
Total Costs	$ 59,782,000	Total Benefits	$ 56,403,000
Net Cost	$ 3,379,000	Benefit/Cost Ratio:	0.944

Alternative A, implementation of APADE NFCS-wide is certainly feasible, producing a net present value benefit of $139,173,000. Adoption of this alternative successfully achieves standardization of procurement processing for all NFCS activities, and sets the stage for further development of the FENICS project. The costs associated with this alternative are, however, much more susceptible to change due to the heavy reliance on unstable telecommunications costs. Both APADE alternatives have the added benefit of significantly reducing PALT to a maximum of seven days.

C. RECOMMENDATIONS

The NAVSUP goal for complete automation of the NFCS to provide a paperless procurement environment is potentially achievable through Alternative A. However, this alternative is subject to significantly higher total cost and increased uncertainty as to the future behavior of relevant costs. This is primarily due to the tremendous increase in the number of activities covered, their greater geographic dispersion, and the associated impact from already unstable telecommunications costs. The appropriate means to provide APADE capability to the activities with purchase authority of $1,000 and less, is through the use of desktop computers with the capability of running the APADE application package or pertinent portions thereof. As stand alone systems, they would also possess batch processing interface capability with major APADE sites. This technology is currently under development by Tandem Corporation and is expected to be functional within the next three to five years [Ref. 36]. This alternative would eliminate a significant portion of the recurring telecommunications cost for those 577 activities. It would also eliminate the need for additional APADE/SPLICE major hardware components that would otherwise be necessary to facilitate the networking of the additional 577 activities.

Based upon the established significant need for automation of those activities with purchase authority in excess of $1,000, and the comprehensive capability of the APADE system to immediately satisfy those needs, Alternative B is recommended for implementation. Use of APADE at the 291 activities covered under Alternative B would place an additional 37.45% of total Navy procurement actions and 6.79% of additional total procurement dollar value under a standard automated procurement system, based upon FY 1985 procurement activity. The total procurement volume covered under the automation afforded by APADE and ICP resystemization becomes 88.26% of total transactions and 97.73% of total procurement dollar value with the implementation of Alternative B. The selection of Alternative B will require a smaller initial committment of resources than would Alternative A. It provides for a more conservative expansion of the APADE system, and does not inhibit the potential expansion of APADE to those 577 smallest NFCS activities not immediately encompassed by Alternative B. Total APADE project costs and benefits with the addition of Alternative B are illustrated in Table XXX.

It is further recommended that an operational evaluation of this alternative be conducted through the use of prototype activities in the vicinity of an existing operational APADE site. At this time, NSC Norfolk represents the best location due to its implementation status, the local availability of training, and the number of non-APADE procurement activities within local telecommunications coverage. Prime candidates for selection as prototype sites in the Norfolk area are NAS Oceana and CINCLANTFLT Support Activity. The use of prototypes will allow for a better evaluation and analysis of system impact generated from increased independent satellite useage of the APADE system.

TABLE XXX

TOTAL APADE COST/BENEFIT SUMMARY WITH ALTERNATIVE B

Costs		Benefits	
Nonrecurring:		Price Savings:	
Current*	$ 60,426,000	Current*	$286,735,000
Alt. B	35,736,000	Alt. B	157,051,000
Tot. Nonrec.	$ 96,162,000	Tot. Price Savings	$443,786,000
Recurring:		Productivity:	
Current*	$ 35,220,000	Current*	$ 50,258,000
Alt. B	29,319,000	Alt. B	1,097,000
Tot. Recur.	$ 64,539,000	Tot. Productivity	$ 51,355,000
		Backlog Reduction:	
		Current*	$ 864,000
		Alt. B	1,150,000
		Tot. Backlog Red.	$ 2,014,000
Tot. PV Costs	$160,701,000	Tot. PV Benefits	$497,155,000

Total Net Benefit $336,454,000   Benefit/Cost Ratio: 3.094

*Source: [Ref. 6: Appendix A]

APPENDIX A

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APPENDIX B

ABBREVIATIONS AND ACRONYMS

AAM - Automated Acquisition Module

ADPE - Automated Data Processing Equipment

APADE - Automation of Procurement and Accounting Data Entry System

APPMS - Automated Procurement Production and Management System

APTS - Automated Procurement Tracking System

ASO - Aviation Supply Office

ASPIRE - Automated Status of Purchasing Information Recorded Electronically

BA&H - Booz-Allen and Hamilton

BCAS - Base Contracting Automation System

BML - Bidders Mailing List

BPA - Blanket Purchase Agreement

CAI - Computer Aided Instruction

CBD - Commerce Business Daily

CHINFO - Chief of Navy Information

CICA - Competition In Contracting Act

COMM - Communications

COMNAVAIRPAC - Commander, U.S. Naval Air Forces, Pacific

CPU - Central Processing Unit

CRT - Cathode Ray Tube

D/O - Delivery Order

DFAR - Defense Supplement to the Federal Acquisition Regulation

DLSIE - Defense Logistics Studies Information Exchange

DOD - Department of Defense

DTIC - Defense Technical Information Center

FAR - Federal Acquisition Regulations

FENICS - Functionally Enhanced Navy Integrated Contracting System

FMSO - Fleet Material Support Office

FSCM - Federal Supply Code of Manufacturers

ICP - Inventory Control Point

IDA - Integrated Disbursing and Accounting System

IFB - Invitation for Bids

ILSMIS - Industrial Logistics Support Management Information System

JCL - Consolidated List of Debarred, Ineligible or Suspended Contractors

M/S - Milestone

MILSCAP- Military Standard Contract Administration Procedures

MIN - Minutes

MIS - Management Information System

NARF - Naval Air Rework Facility

NARSUP - Navy Acquisition Regulation Supplement

NAS - Naval Air Station

NATT - Navy's APADE Training Team

NAVDAC - Naval Data Automation Command

NAVRESSO - Navy Resale and Services Support Office

NAVSEA - Naval Sea Systems Command

NAVSUP - Naval Supply Systems Command

NFCS - Navy Field Contracting System

NRCC - Navy Regional Contract Center

NROTC - Naval Reserve Officers Training Corps

NSC - Naval Supply Center

NSN - National Stock Number

OFPP - Office of Federal Procurement Policy

PALT - Procurement Action Lead Time

PATF - Procurement Action Task Force

PC - Personal Computer

PR - Purchase Request

PSN - Presolicitation Notice

R&D - Research and development

RFP - Request for Proposal

RFQ - Request for Quotation

SADBU - Small and Disabled Business Utilization Specialist

SECNAV - Secretary of the Navy

SORB - Supply Operations Review Board

SPCC - Navy Ships Parts Control Center

SPLICE - Stock Point Logistics Integrated Communications Environment

SYMIS/MM - Shipyard Management Information System, Material Management

UADPS-SP - Uniform Data Processing System-Stock Point

UIC - Unit Identification Code

APPENDIX C

APADE Implementation Phases

The Automation of Procurement and Accounting Data Entry (APADE) system is comprised of seven functional areas, or subsystems that will be implemented in five distinct phases. Each of the five phases provides complete functional support of a major procurement process. The phases will be implemented as they are designed and released by the Fleet Material Support Office (FMSO), who will also be responsible for the prototype testing of each phase. Each phase will be fully compatible with all previous phases so that unimpeded processing support will be maintained. The gradual implementation by phases is expected to enhance user acceptance by reducing the turmoil created by automating a formally all manual processing system [Ref. 15].

Phase I, implemented at NSC Norfolk in April 1986, provides support for the small purchase function. Key support functions for Phase I are:

1. Requisition Input/Update Processing.
2. Award Processing.
3. Inquiry Processing.
4. Report Processing.
5. System Management Processing.

Phase II, anticipated for release in July 1986, provides for enhancements to the small purchase function, and interfacing with UADPS-SP and SYMIS/MM for the automated receipt of requisitions.

Phase III, due in January 1987, is designed to provide contract administration responsible activities with enhanced contract document tracking capability.

The implementation of Phase IV in July 1987, will complete the automation necessary to perform all contracting processes.

Phase V, anticipated to be released in March 1988, is a management information support enhancement that will provide the capability for Military Standard Contract Administration Procedures (MILSCAP) processing and additional management information support.

APPENDIX D

SMALL ACTIVITY QUESTIONNAIRE

ACTIVITY:______________________________ DATE/TIME:____________________

INTERVIEWEE:___________________________ TITLE:________________________

1. WHAT WAS YOUR ACTIVITY'S PURCHASE VOLUME FOR FY 1985 IN BOTH NUMBER OF TRANSACTIONS AND DOLLAR VALUE?

NUMBER:_________________ DOLLAR VALUE:__________________

2. HOW MANY PURCHASE ACTIONS WERE PASSED TO ACTIVITIES WITH A HIGHER PURCHASE AUTHORITY? WHICH ACTIVITY DO YOU PASS TO?

NUMBER:___________ $ VALUE:__________ ACTIVITY:_________________

3. WHAT IS THE APPROXIMATE NUMBER OF PURCHASE TRANSACTIONS AT YOUR ACTIVITY EACH WEEK? AVERAGE NUMBER OF LINE ITEMS?

NUMBER TRANSACTIONS/WEEK:______ NUMBER LINE ITEMS:________________

4. WHAT IS THE SIZE OF YOUR SUPPORT STAFF?

BUYERS:_____________ CLERICAL:____________ OTHER:____________

5. DO YOU EVER EXPERIENCE BACKLOGS OF REQUISITIONS FOR PROCESSING?

FREQUENCY:________ SIZE IN # REQNS:______ SIZE IN MAN HRS:_______

6. WHAT IS YOUR PROCUREMENT ACTION LEAD TIME? ______________________

7. DO YOU CURRENTLY HAVE ANY AUTOMATED CAPABILITY? IF SO, PLEASE DESCRIBE:

8. ARE YOUR PURCHASE DOCUMENTS PREPARED MANUALLY?

9. WHAT RECORDS ARE MAINTAINED FOR HISTORICAL PURPOSES, REPORTING PURPOSES, AND/OR FOR TRACKING PURPOSES?

HISTORICAL:

REPORTING:

TRACKING:

10. DO YOU FEEL THAT YOUR PROCUREMENT ACTIVITY SHOULD BE AUTOMATED? WHAT DO YOU FEEL WOULD BE THE GENERAL COSTS AND BENEFITS FROM SUCH AUTOMATION?

11. COULD YOU OPERATE WITHOUT PURCHASE AUTHORITY, AND SEND ALL OF YOUR REQUIREMENTS TO THE CLOSEST ACTIVITY WITH $10,000 PURCHASE AUTHORITY VIA IMMEDIATE ELECTRONIC TRANSFER? WHAT ADVANTAGES/DISADVANTAGES DO YOU SEE IN SUCH A SYSTEM?

12. THANK YOU FOR YOUR TIME AND COOPERATION.

APPENDIX E

SYSTEM'S HARDWARE PRICING

I. APADE Pricing

Item	U/I	Unit Price
PC Workstation	Ea	$ 2,995
Terminal Workstation	Ea	2,125
Low Speed Laser Printer	Ea	22,000
Modem	Ea	4,225
Modem Sharing Device	Ea	25
Tandem 6600 Cluster Control	Ea	1,800
Processor Subsystem	Lo	149,268
Disk Subsystem	Lo	53,769
Communications Subsystem	Lo	132,006
Emulator/Other Software	Ea	1,200

II. APTS/APPMS Pricing

Item	U/I	Unit Price
PC Remote Station	Ea	$ 3,800
4230A Terminal Station	Ea	1,870
Printer	Ea	2,000
Modem and Software	Se	500
Wang VS 65	Ea	16,958
Disk Storage Cabinet	Ea	19,125
Add-on Disk Storage	Ea	8,500
APPMS Application	Ea	100,000

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